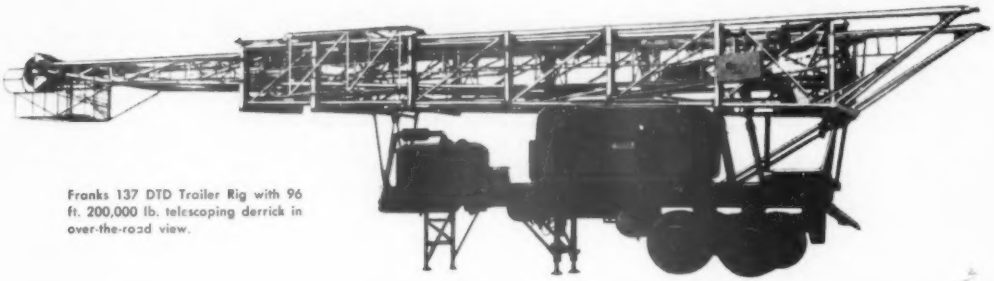
the OIL AND GAS JOURNAL

GREATEST CAPACITY YET LIGHTEST TRAILER RIG ON THE MARKET



Franks 137 DTD Trailer Rig with 96 ft. 200,000 lb. telescoping derrick in over-the-road view.

WHAT TWO FRANKS RIG OWNERS SAY...

"Most satisfactory workover and servicing trailer rig I have ever used . . . one trailer rig moved to 25 locations in 8 months without any major repairs."—**H. V. Middleton, H. V. Middleton, Inc., Oklahoma City.**

Franks offers a trailer rig par excellence—having the greatest capacity of any mounted drilling and workover rig, yet lighter than any competitive rig. It has Franks famous hoist embodying the smoothest high capacity clutch yet developed; hydraulically adjusted and equalized brakes; and Franks famous telescoping derrick. Franks trailer rigs by saving time on moves, rig-up and rig-down, plus equivalent drilling or workover time, have proven a money maker. There's a model to fit your needs for drilling up to 6,000 ft. with 3½ in. drill pipe and for deepest workover, diesel or gas-gasoline powered (125 to 300 hp. for various models) thru a torque converter drive. See a Franks representative for full details on the many features we haven't space to describe here. Or write for further information.

FRANKS MANUFACTURING CORP.
Box 3218 Tulsa, Oklahoma
Export, 149 Broadway, New York, N. Y.

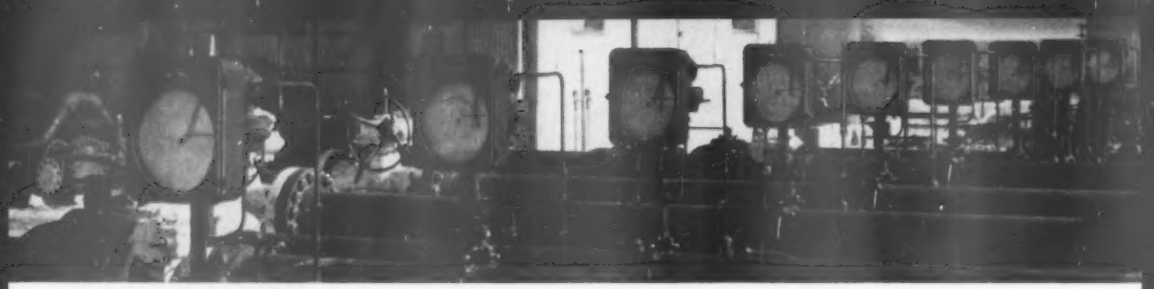
"Our Model 137 DTD Franks rig . . . has been a money maker from the first job . . . we feel we are able to show greater profits at competitive footage prices than are other type rigs operating in our area."—**Horace Coon, Jr., Parish & Coon Drilling Co., Houston.**

FRANKS 24-HOUR "On the Spot" FIELD SERVICE

available at Alice, Casper, Compton, Great Bend, Houston, Kilgore, Odessa, Seminole, and Tulsa with stock of parts and factory-trained personnel.

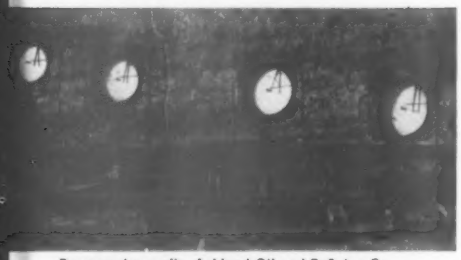
FRANKS MFG. CORP.
WELL SERVICING AND DRILLING UNITS
TULSA, OKLAHOMA

PRICE 50 CENTS TABLE OF CONTENTS PAGE 77 **MAY 19, 1952**

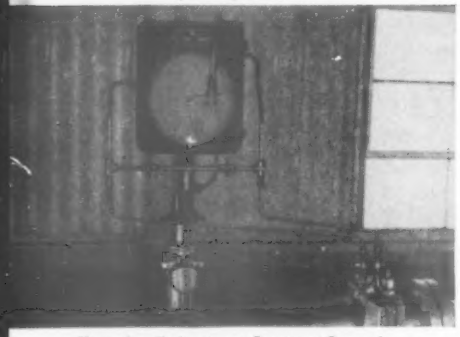


Gas booster station, Lion Oil Company, Scurry County, Texas

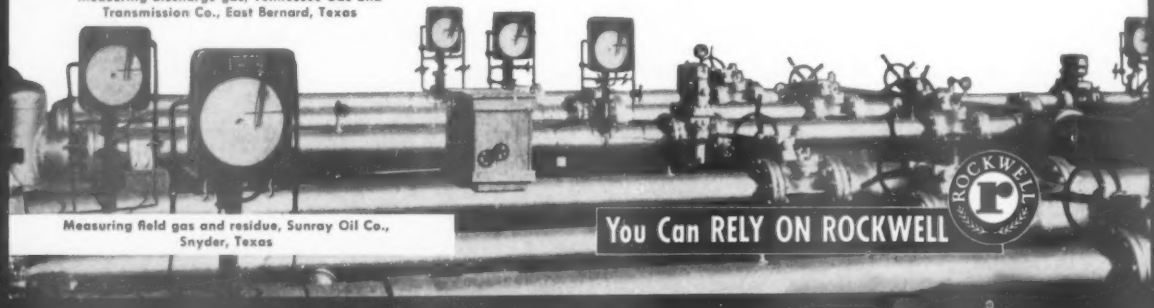
Wilshire Oil Company, Snyder, Texas



Repressuring wells, Ashland Oil and Refining Co., Spaulding, Okla.



Measuring discharge gas, Tennessee Gas and Transmission Co., East Bernard, Texas



Measuring field gas and residue, Sunray Oil Co., Snyder, Texas

YOU'LL GET GREATER YIELD

in Station or Field

from

ROCKWELL

ORIFICE METERS

You see Rockwell orifice meters *everywhere* in the oil and gas industry. Instrument-accurate performance, low maintenance costs and service ease are the big reasons for the swing to Rockwell. It's all wrapped up in a better engineered design having a more accessible assembly with heavier parts of improved materials. Ask your Rockwell representative to demonstrate these advanced features, or write for Bulletin 1050.

Your operator can mechanically calculate up to 300 average charts a day on a Rockwell Integrator. She does it with machine precision by tracing the same static and differential lines that were left by the pens on the gauge. Accuracy within ½ of 1 per cent is practical. Full description in Bulletin 1016.

ROCKWELL MANUFACTURING COMPANY

PITTSBURGH 8, PA.

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You Can RELY ON ROCKWELL

IDENTIFICATION DISC: An aluminum marking plate on all Walworth No. 225P's facilitates inventory control and makes reordering quick and positive.

take a good look at the Walworth "500 Brinell" no. 225P Globe

NEWLY DESIGNED HANDWHEEL: Patented air-cooled, finger-fit handwheel affords sure grip even with greasy gloves.

– the Toughest Bronze Valve Your Money Can Buy

The stainless steel, corrosion resistant seats and discs are heat treated to a hardness of 500 Brinell – hard enough to scratch glass and crush nails! The valve can be closed on sand, slag, and pipe scale without injury to the seating surfaces. "Wire drawing" is practically eliminated. All parts are accurately machined and gaged. Years of tight, positive shut-off are assured.

Available in both globe and angle types (angle type: No. 225 P) in sizes ¼" to 2", this quality valve is recommended for 350 lbs. W.S.P. at 550 F, and 1000 lbs. non-shock service on cold water, oil, gas, or air.

For full data on this long-life, economical Walworth Bronze Valve, see your local Walworth distributor, or write for Circular.

IMPROVED PACKING: Molded packing of lubricated asbestos reinforced with copper wire. Suitable for practically every service. Valves can be repacked under pressure when fully opened.

note these 7 Great Features

HEXAGONAL UNION BONNET CONNECTION, DEEP STUFFING BOX AND RUGGED STUFFING NUT: Union bonnet connection eliminates any chance of distortion or leakage even though valve is repeatedly taken apart and reassembled.

OVERSIZE STEM: The high-tensile strength silicon-bronze stem assures long life and protection against wear.

SEATS AND DISCS: Plug type seats and discs of stainless steel, heat-treated to 500 Brinell hardness and machined simultaneously to a mirror-like finish, with accurate tapers assures tight positive shut-off with minimum handwheel effort.

EXTRA STRONG BODY: Made of Composition M (ASTM B61) bronze. Thick walls and rugged hexes provide a high safety factor. Valves undergo hydrostatic shell test of 1,000 psi.

WALWORTH

valves and fittings

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The Oil and Gas Journal, published Mondays, copyright 1952, by The Petroleum Publishing Company. Entered as second-class matter September 1, 1910, at post office at Tulsa, Okla., under act of March 3, 1879. U. S. and foreign rates to the petroleum industry, $4 yearly.

Built Up..

to Oil Field Standards!

Fairbanks-Morse 8-Cover Side-Pot Duplex Power Pumps are built *UP* to the rugged design and conservative standards of oil field pump practice . . . built *UP* to last . . . built *UP* to liberal strength and safety factors.

They are not built down to achieve lighter weight with consequent sacrifice in design, materials and dependability. Light weight in an oil field power pump is a dubious advantage at best. Strength and service are the important considerations.

When you want dependable, efficient, long-life, low-cost service, your choice should be Fairbanks-Morse, the power pumps that set performance and economy records wherever they are used. Fully bronze-fitted, oil-fitted, or slush-fitted styles, Fairbanks, Morse & Co., Chicago 5, Ill.

FAIRBANKS-MORSE,

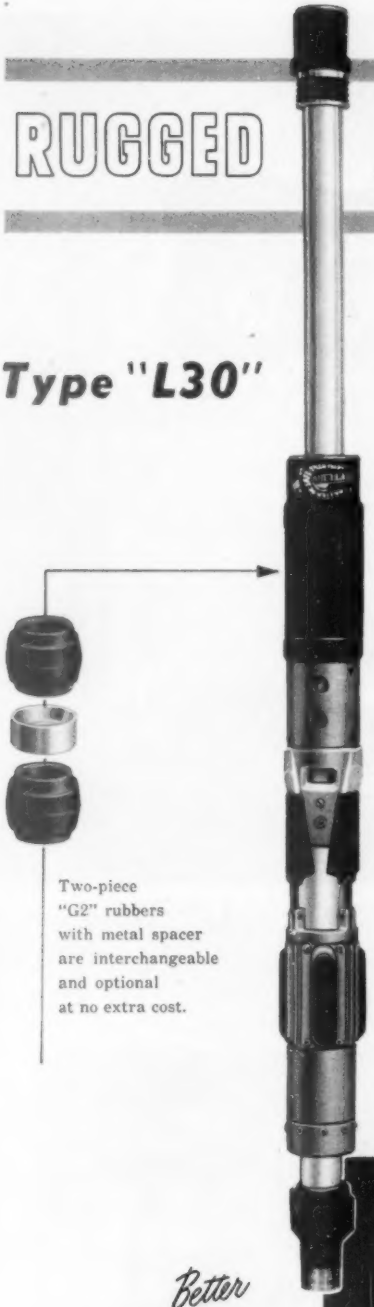
a name worth remembering

OIL FIELD EQUIPMENT • PUMPS • SCALES
ELECTRIC MOTORS • GENERATORS • LIGHT PLANTS
DIESEL, DUAL FUEL AND GASOLINE ENGINES • MAGNETOS

RUGGED AND RELIABLE

GUIBERSON'S
Deep Well Packer

Type "L30"



Two-piece "G2" rubbers with metal spacer are interchangeable and optional at no extra cost.

For deep well work with high temperatures and pressures, use Guiberson's dependable "L30" Packer. It will give you long valve travel (30 inches) with minimum overall length at no extra cost. You can pull the "L30" surely and safely. The fast-action automatic latch, protected by a positive anti-lock device that assures ready release, snaps easily into latched position. Tough, long-wearing friction pads supply ample drag. Packing rubbers of advanced design will not vulcanize to the casing wall. All these features and others too are available on the "L30" in a wide range of casing sizes.

For circulating *above* the packer, Type "L30P" with perforated mandrel is available. Packers with longer or shorter valve travel may also be had on special order.

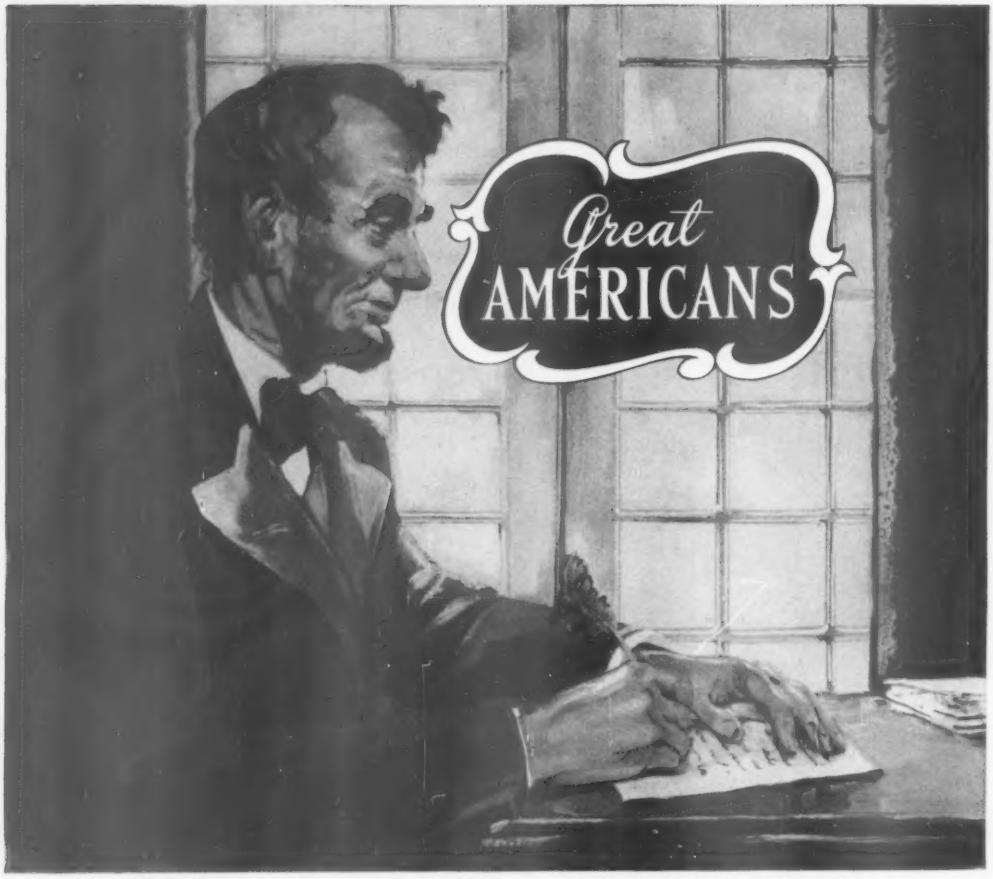
Better Be Safe Than Sorry

GUIBERSON

CORPORATION

ESTABLISHED 1919 • DALLAS, TEXAS, U. S. A.

Sold By Leading Oil Field Supply Stores Everywhere



"If we do not make common cause to save the good old ship of the Union on this voyage, nobody will have a chance to pilot her on another voyage."

—ABRAHAM LINCOLN (1809–1865)

AMERICAN PUMPING UNITS are great for pumping year-in and year-out with a minimum of attention and servicing. Throughout the oil country you will find American Units that have been pumping continuously for 18 years and longer. There is a size for every requirement. Write for Catalog 151. Contact your favorite supply store or the nearest American office.

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IN *Oil Field* WORK

NO TRUCK EQUALS

OSHKOSH

• FOR *all-wheel* POWER

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The "secret" of Oshkosh's all-wheel power is the automatic locking center differential in transfer case in 4x4 models. Simple and rugged. Only Oshkosh has it. 6x6 models have front axle declutch type transfer case for on and off road flexibility.

For 34 years Oshkosh trucks have been oustanding for power—durability—stamina. Ruggedly built for off-highway hauling, drilling, and handling heavy loads in oil field service.

Today, when every dollar counts, it's sound business to compare trucks from every angle; initial cost, maintenance, and length of service. Make this comparison — and you'll choose Oshkosh. Ask any user!

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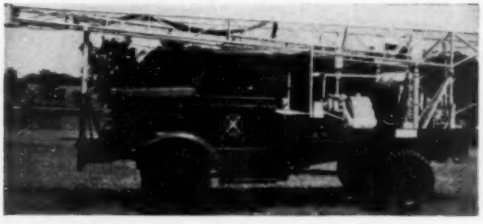
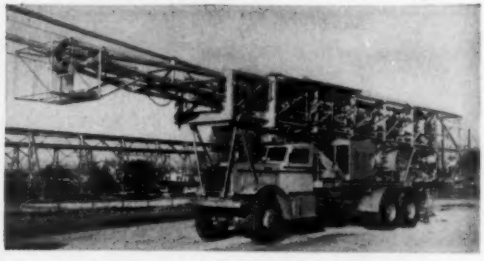




OSHKOSH 4 and 6 WHEEL DRIVE TRUCKS

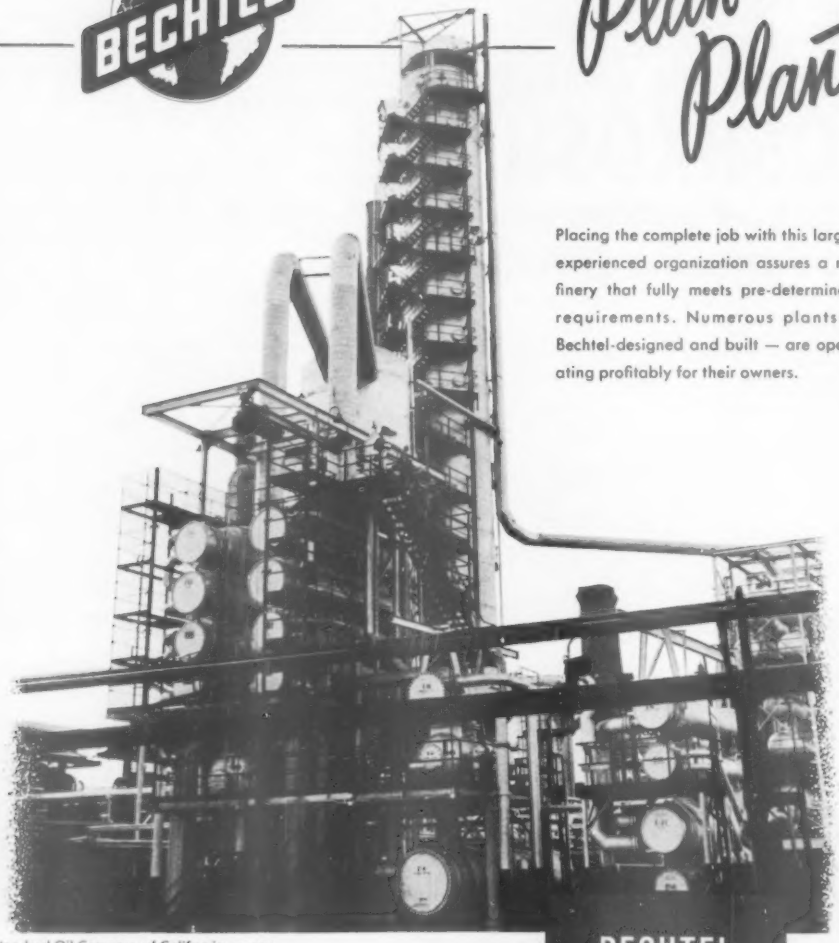
OSHKOSH MOTOR TRUCK INC.

OSHKOSH WISCONSIN

BECHTEL ALL THE WAY...

Plan to Plant

Placing the complete job with this large, experienced organization assures a refinery that fully meets pre-determined requirements. Numerous plants — Bechtel-designed and built — are operating profitably for their owners.



Standard Oil Company of California, owner.

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Los Angeles • New York

WE WERE MAKING THEM IN YOUR GRANDFATHER'S TIME

Bethlehem started making drop forgings many years ago . . . when most of our present customers were very small boys or weren't around at all.

Today we're still going full-tilt as our hammers and presses turn out new designs for the petroleum, mining, aviation, automotive, electrical, and other industries. These are good forgings, made with great care and attention to detail—yet produced in volume so that many needs can be served.

Whenever your specifications call for a closed-die forging, talk first with Bethlehem. Our very broad experience in the field of drop, press, and upsetter forgings can be helpful to you.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

Every Oil Field Fleet Needs a WALTER!

—to handle the jobs* no other trucks can do!

***Hauling heavy loads in any weather or ground conditions — through mud, sand, rough country, snow, ice, steep grades — without stalling or bogging down.**

***Exploring remote country — hauling equipment to new sites — rushing servicing equipment on emergency calls — wherever men and equipment *must* get through "impossible" conditions.**

HAVING one or two Walter Tractor Trucks in your fleet is like an insurance policy on your operations. Walter Tractor Trucks haul where others stall—keep big loads moving in conditions impassable and inaccessible for other wheeled vehicles. They travel at truck speeds, need no slow-moving crawlers, need no special roads. Here are the reasons:

The Walter 4-Point Positive Drive provides positive driving action in four wheels—two front, two rear. A patented "mechanical brain" automatically powers each wheel according to its traction, prevents wheel spinning, assures steady pulling power. Large, single low-pressure tires and high ground clearance increase cross-country rolling ability.

Walter Tractor Trucks are specially designed for off-the-road hauling—are big, powerful, rugged in every detail—have a combination of engineering features found in no other truck. Get the full story from your distributor—or write us direct.

Walter Oilfield Tractor

Fast, compact, highly mobile carrier for servicing and exploratory equipment. Gets to locations formerly inaccessible for wheeled vehicles. 100% four-wheel traction, 125 hp. engine, single 14:00-20 tires, 30-40 mph on normal roadways. Models from 16,000 to 36,000 gvw.

Heavy Trailer Hauling

240 hp. Walter Tractor Truck, on 16:00-24 single tires, hauls rigs, pipe and equipment to any location. Payloads up to 50,000 lbs., gross train weights up to 80,000 lbs. hauled on or off highway, within legal axle and width limitations.

Walter Crane Truck

240 hp. Walter Tractor Truck, on 16:00-24 single tires, with 10-ton, 18 ft. telescoping crane extendable to 25 ft., and 40,000 lb. power winch. Pulls, lifts or carries heavy loads over soft, rough ground conditions.

WALTER MOTOR TRUCK COMPANY

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4-POINT POSITIVE DRIVE
TRACTOR TRUCKS
Haul where others stall

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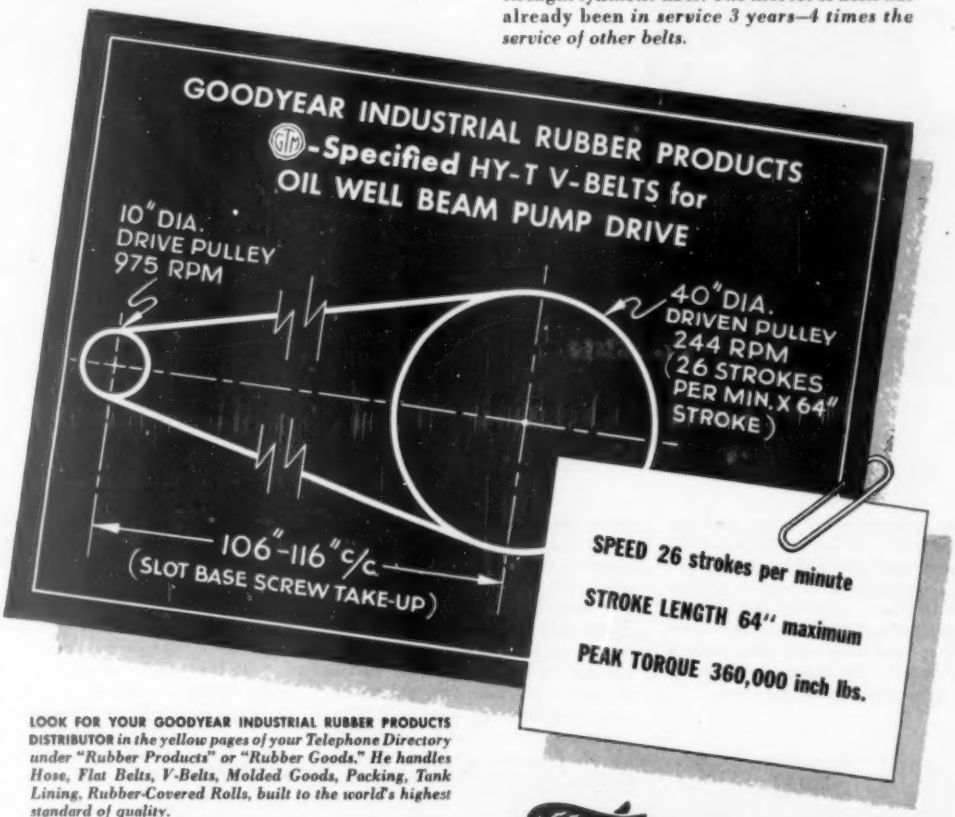
4 TIMES the service

Hy-T V-Belts Handle Tough Oil Well Drive

Best previous belt life on this 9-belt beam pump drive was 1 year, but *average service of all belts tried was 6 months to 9 months.*

The G.T.M.—Goodyear Technical Man—recommended powering the drive with Goodyear's HY-T belts, built with multi-plies of high-strength synthetic fiber. The first set of belts has already been *in service 3 years—4 times the service of other belts.*



LOOK FOR YOUR GOODYEAR INDUSTRIAL RUBBER PRODUCTS DISTRIBUTOR *in the yellow pages of your Telephone Directory under "Rubber Products" or "Rubber Goods." He handles Hose, Flat Belts, V-Belts, Molded Goods, Packing, Tank Lining, Rubber-Covered Rolls, built to the world's highest standard of quality.*

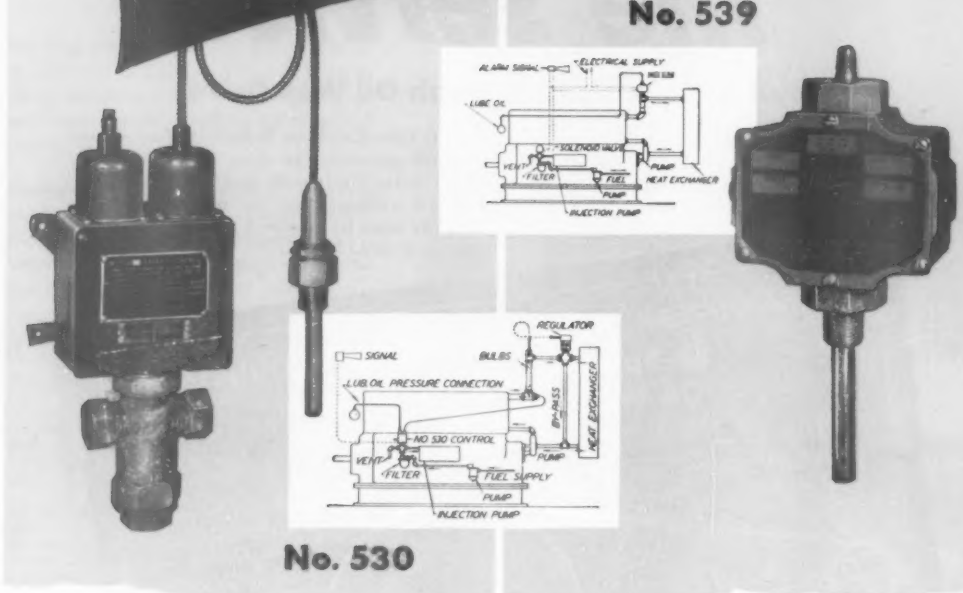
GOODYEAR

THE GREATEST NAME IN RUBBER

Hy-T—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

We think you'll like "THE GREATEST STORY EVER TOLD"— Every Sunday — ABC Network

Guards engines 24 hours a day!



IDEAL FOR REMOTE LOCATIONS

These Sylphon Engine Safety Controls can save you *plenty*—protect you day and night against costly shutdowns, damage or repairs. For example, installed on engines at remote pumping stations, where service men may visit only once a day or less, they guard against overheating or failing oil pressure.

With No. 530 Safety Control, if cooling water temperature goes above, or lube oil pressure goes below the safe point, the engine is immediately stopped. Should the thermostat assembly develop a leak due to accidental injury, the safety control immediately trips to the shutdown position. No. 530 can be supplied with or without valve, pressure connection, or alarm switch. Adaptable to practically any specified conditions.

No. 539 Safety Control also protects against high jacket water temperature or low lube oil pressure. If either condition occurs, it sounds an alarm—or shuts off the engine. No. 539 is also available for temperature or pressure only.

Both controls are widely used for many types of internal combustion engines. Rugged . . . reliable . . . built for years of economical service. For information, write for Bulletin KO-817.

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Temperature Controls • Bellows Devices • Bellows Assemblies

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Canadian Representatives, Darling Brothers, Montreal

LANE-WELLS 10 SERVICE

a tiny button you may not notice

is one great assurance of "perforating jobs done right!"

You don't get much chance to see this button, because usually your Lane-Wells man won't have it on his work shirt. But you'd be surprised to know how many Lane-Wells men have these buttons, which tell of five, ten, fifteen or more years of continuous service with Lane-Wells.

These service buttons represent your greatest assurance of a job done right, because they represent oil field experience—and the reservoir of knowledge that comes with it. The men who can wear these buttons have met nearly every perforating problem an oil well can throw at you, and when the answers weren't in the book, they've made their own answers—and seen them become standard practice in one field after another. The thousands of man-years of experience these buttons represent—the oil field know-how gained in 170,000 perforating jobs—are why...

Operators from California to Kentucky can tell you

Call LANE WELLS for Better Perforating

Tomorrow's Tools Today!

AG-505

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WHELAND
HIGH SPEED ROTARIES

A-17-A	17½"	Opening through table	53¼" Centers
A-17-C	17½"	Opening through table	44" Centers
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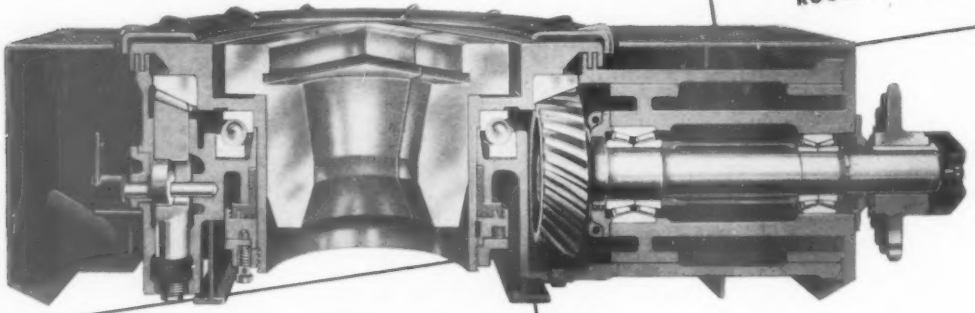
PRECISION BUILT
EASY TO MAINTAIN
CUTS RIGGING UP TIME
RUGGED . . . QUIET



DOUBLE LABYRINTH MUD SEAL
CARTRIDGE TYPE PRESSURE GREASE LUBRICATED PINION
ASSEMBLY REMOVABLE AS A UNIT

WHELAND

THE WHELAND COMPANY, CHATTANOOGA, TENN., U. S. A.
ROTARY DRILLING MACHINERY

DRAWWORKS • SLUSH PUMPS
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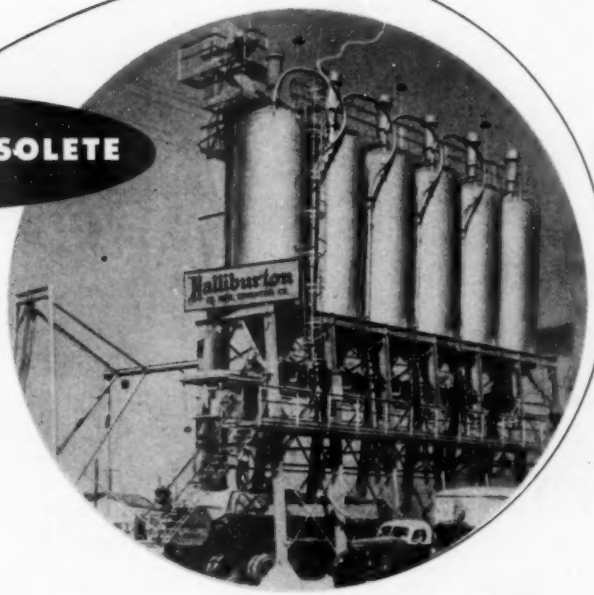
EXPORT DISTRIBUTOR: Lucey Export Corporation, 233 Broadway, New York 7, New York — Broad Street House, London E. C. 2, England

SACKS ARE OBSOLETE



with HALLIBURTON BULK CEMENTING

Originated and introduced by Halliburton in 1940, Bulk Cementing is cutting costs throughout nine major oil producing states. Today, large, efficient fleets of Halliburton freight cars, bulk cement convoys and portable field convoys deliver thousands of tons of *fresh, dry, uncaked* cement in all kinds of weather!

Save in every way! From 2 to 10% waste, when dumping sack cement at the well, is positively eliminated. *And* because you never lose a single pound due to weather in transit or storage... because you pay for only the cement actually mixed at the well ... because you cut the cost of unnecessary pick-up labor to handle sacks, Halliburton Bulk Cementing is sure to save you money.

Better in every way! You get a better cementing job with a more uniform mix. You get the equally important advantage of speed. When using special mixes, you simply can't equal the engineered efficiency of Bulk Cement Plants equipped with accurate automatic mixers. And, with fewer men on the job, you enjoy the peace of mind of reduced industrial accidents.

This clean-cut handling, famous for swift efficiency, gives you the kind of service that Halliburton is proud to say is *exclusively* Halliburton's.

There are 45 Halliburton Bulk Cement distribution stations located in active oil territory, ready 24 hours a day, 7 days a week, to bring you a cementing service that gives important savings in your drilling costs and makes sacks obsolete. Phone your nearby Halliburton Representative. Halliburton Oil Well Cementing Company, Duncan, Oklahoma.

YEARS AHEAD IN CEMENTING SERVICE!

HALLIBURTON

Monsanto reports on corrosion-prevention test in tankers

Several months ago, the Monsanto advertisement reproduced here told you of a test of the effectiveness of Santolene C in preventing corrosion in tankers. This is a report of the results.

How test was made: Strips in two cargo compartments in a tanker were sandblasted clean. Petroleum products carried in these compartments were treated with Santolene C at the rate of 12#/1000 bbls. Two other compartments were cleaned for comparisons. Untreated petroleum products were carried in them. One treated and one untreated test compartment always made the return trip containing salt water ballast.

Here are results: After 8 months, the compartments were inspected. Sandblasted strips in tanks carrying Santolene C had alight, soft scale that could be removed by wiping. Areas not sandblasted had a dull, oily appearance. There was apparently no new scale on these areas and the scale present was clinging tightly to the sides. (This was scale that had been left on the metal when the test started.)

A hard, rust-red scale had formed on the sandblasted areas of the compartments without Santolene C. Large sheets of old scale were falling from the sides.

During the period of the test, 153,000 pounds of scale was removed from all compartments of the ship. Scale removed from the two tanks in which Santolene C treated products were carried was 50% to 60% less than that removed from the untreated compartments of the ship.

If you have a corrosion problem in carriers or in static storage of light petroleum products, consider Santolene C. For literature and technical information, write MONSANTO CHEMICAL COMPANY, 1700 South Second Street, St. Louis 4, Missouri.

Santolene: Reg. U. S. Pat. Off.

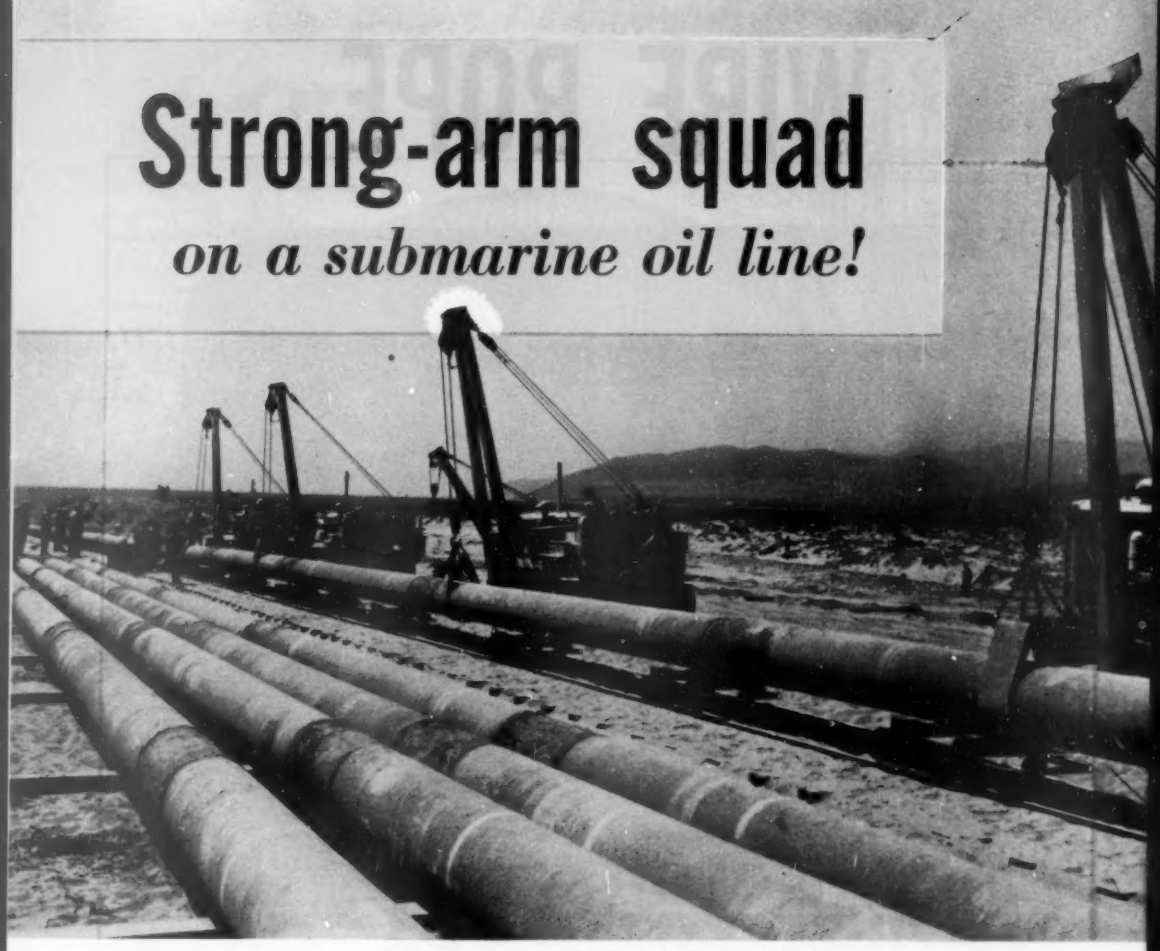
SANTOLENE C

MONSANTO
CHEMICALS – PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

Strong-arm squad

on a submarine oil line!



You're looking at the longest and largest submarine oil line operation on the west coast. It's located near Ventura, California. Pacific Pipeline Construction Co., the contractor, is using four "Caterpillar" D7 Tractors and one D8 with Trackson Side Booms to handle the pipe.

Two cement-coated lines are being laid, each 4,200 feet long—a 20-inch line for loading tankers and an 8-inch line for unloading them. The 20-inch line weighs 185 lbs. per foot. Here you see the "Caterpillar" teams lifting a 250-foot section weighing 46,250 lbs. onto the trolley ramp which feeds the pipe into the sea. A "Cat" D8 Tractor with No. 8S Bulldozer prepared the approach from the ramp to the sea, and works on the dike that prevents high tides from flooding the launching platforms.

"Caterpillar" equipment has earned a reputation for taking all kinds of pipeline jobs in stride. It's built to stand up under a beating. However, you can get more work out of it by giving it good care. And that doesn't take long—just a few minutes' maintenance a day will pay off for you. So will keeping in touch with your nearby "Caterpillar" Dealer. He's got the know-how and facilities to be of real service!

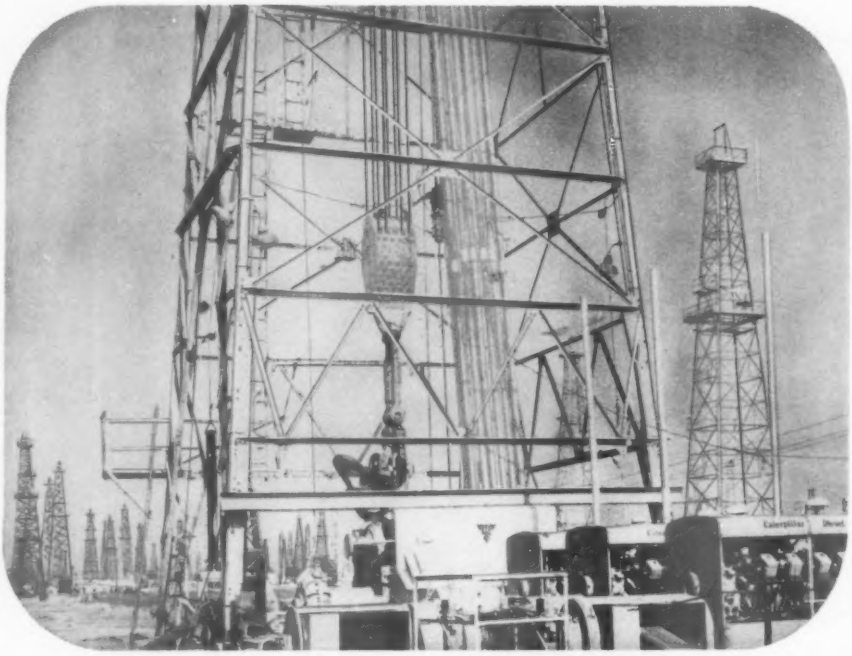
CATERPILLAR, PEORIA, ILLINOIS

CATERPILLAR

REG. U. S. PAT. OFF.

DIESEL ENGINES
TRACTORS • MOTOR GRADERS
EARTHMOVING EQUIPMENT

WIRE ROPE



This is the most economical rope we've ever made for the oil fields

ROEBLING is the best known name in wire rope. That's partly because we were the first wire rope makers in America. But more than that, we've always led in developing better wire and better rope for every purpose.

Today's Roebling Preformed "Blue Center" Steel Wire Rope is the oil man's best choice for efficiency and long life. This rope has *extra* resistance to crushing and abrasion . . . stands up under rough going. It saves you time and cuts costs.

There's a Roebling wire rope of the right specification for top service on any job. Call on your Roebling Field Man for his recommendations . . . District Offices at Cleveland, Denver, Houston, Los Angeles, Odessa and Tulsa. John A. Roebling's Sons Company, Trenton 2, New Jersey.

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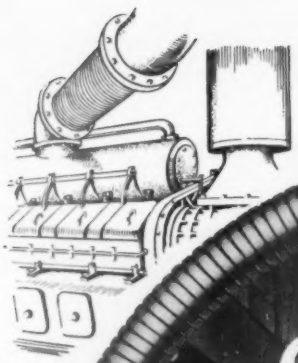
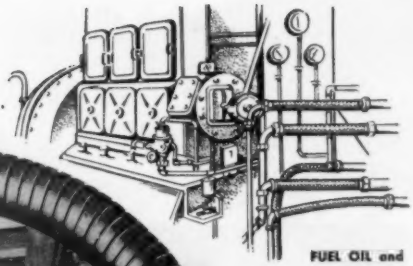
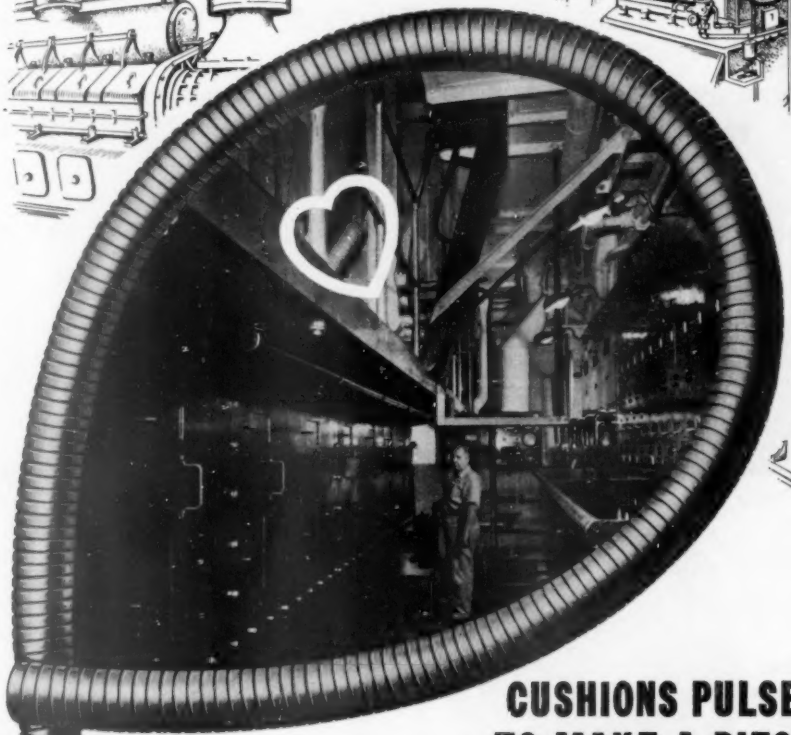
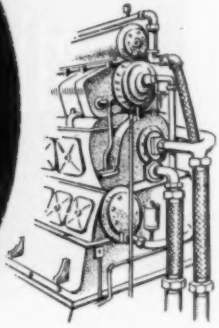


EXHAUSTS and AIR INTAKES



FUEL OIL and STARTING AIR LINES





LUBRICATING OIL and CIRCULATING WATER LINES

CUSHIONS PULSE OF POWER ...TO MAKE A DIESEL PUR-R-R

PENFLEX FLEXIBLE TUBING DAMPS VIBRATION OUT OF TUG "TITAN'S" DIESEL EXHAUST

As she "revs up" for action, the Nordberg Diesel in the powerful "Titan" just purrs like a kitten. One of the secrets of this big ocean-going tug's smooth, vibration-free power is "flexineering"—the scientific engineering of flexible metallic tubing to the specific requirements of the job.

Running from exhaust to stack is a flexible section of 18" Penflex interlocked metal tubing. As the "Titan" flexes its mighty muscles, Penflex flexes to soak up all vibration. Extra outer jacket provides efficient air cooling. Tubing is safe, tight as pipe — but flexible.

In the diesel power field — on exhausts and air intakes . . . fuel oil and starting lines . . . lubricating oil and circulating water lines . . . or the many other places where tubing is used — you'll find Penflex engineers ready and eager to help you solve your toughest tubing problems. For details on Penflex flexible tubing for all diesel applications, write today for your copy of Bulletin 71.

Pennsylvania Flexible Metallic Tubing Company, Inc., 7213 Powers Lane, Phila. 42, Pa.
Branch Sales Offices: **Boston • New York • Chicago • Houston • Cleveland • Los Angeles**

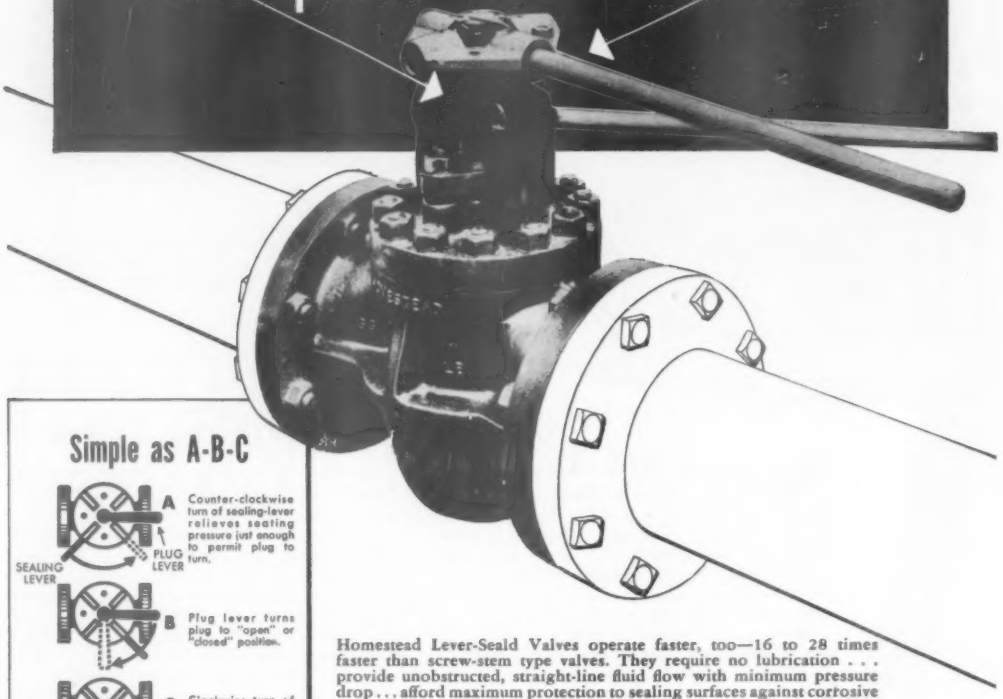
penflex

HEART OF INDUSTRY'S LIFE LINES

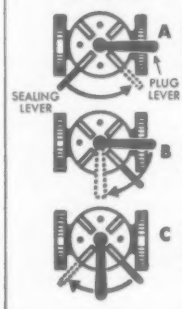
- at all times
- under all conditions
- throughout its long lifetime of service

This Homestead Valve will always work

it's **stickproof** because it's **lever-seald**



Simple as A-B-C


A
Counter-clockwise turn of sealing-lever relieves seating pressure just enough to permit plug to turn.
SEALING LEVER
PLUG LEVER
B
Plug lever turns plug to "open" or "closed" position.
C
Clockwise turn of sealing-lever restores full seating pressure.

Homestead Lever-Seald Valves operate faster, too—16 to 28 times faster than screw-stem type valves. They require no lubrication . . . provide unobstructed, straight-line fluid flow with minimum pressure drop . . . afford maximum protection to sealing surfaces against corrosive and erosive line fluids. And because only a quarter-turn is needed for full opening or closing, they are ideal for installation in restricted areas where operation of other types of valves might be difficult.

Next time you have damaged or sticking valves, replace them with Homestead Lever-Seald Plug Valves. Once you use them you'll never be satisfied with ordinary valves.

For complete information write for Valve Reference Book No. 39-3.

HOMESTEAD LEVER-SEALD PLUG VALVES

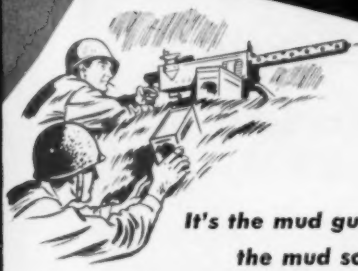
HOMESTEAD VALVE MANUFACTURING COMPANY

Serving since 1892

P.O. BOX 403 CORAOPOLIS, PA.

This GUN Keeps Shooting...

IN PEACE OR WAR



It's the mud gun that mixes the mud so essential to sinking those holes in Mother Earth to keep us supplied with oil.

NON-SPIN MUD MIXING GUN

The CHIKSAN Non-Spin Mud Gun illustrated above can't spin because centrifugal force is neutralized by the offset in the barrel of the gun. Perforated flanges and Locking Pins permit locking the Gun in any desired position.

BOTTOM TYPE MUD MIXING GUN

The CHIKSAN Bottom Type Mud Gun is designed for use where large size metal tanks are employed as mud pits. It is simple in construction, easy to install, and easy to operate.

SPINNER TYPE MUD MIXING GUN

The CHIKSAN Spinner Type Mud Gun is designed for use in tanks where the contents are in constant agitation is desired. The nozzles are set at an angle and the pressure in the line imparts a spinning motion which is accommodated by a Style No. 20 CHIKSAN High Pressure Swivel Joint. Furnished in any desired length as specified on order.

IT requires a tremendous volume of petroleum products to keep us on the go—whether to hold a war plane upstairs or make a factory hum—to send tanks into enemy terrain—keep ships afloat—to help a mower cut a swath through a peaceful golf course.

Chiksan mud guns represent a low cost investment, yet provide complete safety, versatility, and flexibility in the drilling operation. The heart of these guns is the Chiksan Ball-Bearing Swivel Joint, made of tough, hardened metal with long life to keep up the flow of oil that keeps up the flow of industry and defense.

There's hardly an industry, large or small, that can't add flexibility to its operation and decrease upkeep by the use of Chiksan Ball-Bearing Swivel Joints.

Dairy and dockside—food processing and chemical plant—oil field and railroad loading platform—wherever liquid or gas must flow, wherever pressure, heat or cold subjects material and process to fatiguing punishment, there you will find Chiksan on the job—speeding production—cutting down operating overhead.

Write for Catalog No. 51-D Dept. S-OGJ

If plant, process or product needs speeding or improving—if flow of liquid or gas or flexibility of metal is a factor, call upon the Research & Development Division of Chiksan. There's probably a better method awaiting your service that Chiksan has proved in performance or can devise for your special need.

The Flow of Enterprise Relies on **CHIKSAN**

Ball-Bearing Swivel Joints

CHIKSAN TRADE MARK REG.

Representatives in Principal Cities
Sold by Leading Supply Stores Everywhere

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SERVICE HOURS

...*not Footage*

The True Yardstick of Air Hose Value

When buying air hose, your thinking should not be in terms of footage-per-dollar but rather in terms of service hours.

Experience tells you that the hose which is built with an *extra* measure of strength, flexibility, damage resistance and safety is surely your soundest investment.

This is true of *every* BWH Air Hose. Each has been specifically developed, tested and field-proven to give maximum long, trouble-free life in its job.

Get in touch with your BWH distributor — *today*.

BWH
DEPENDABLE RUGGEDNESS

BOSTON WOVEN HOSE & RUBBER COMPANY

Distributors in all Principal Cities

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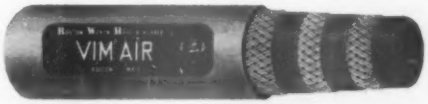
P.O. BOX 1071, BOSTON 3, MASS., U.S.A.
Warehouse Stock, 111 N. Canal St., Chicago, Ill.

CONCORD AIR — An extra quality, exceptionally rugged hose for toughest use on air drill and pneumatic service in mines, quarries and construction jobs. Non-porous tube resists heat and oil. High tensile cotton yarn braid reinforced carcass. Tough grey cover resists cutting, gouging, abrasion. 7 sizes from ½" 2-braid through 2" 3-braid. 200 to 300 lbs. working pressure. Maximum length 50'.

BAY STATE AIR DRILL — For heavy construction work in mines, quarries, tunnels and wherever large size hose is required for long service. Smooth black tube resists heat and oil. Carcass of strong, rubber-impregnated multiple ply woven duck. Rugged, heavy-gauge red rubber cover resists severe weather extremes, cutting, abrasion. 9 sizes stocked from ½" to 4". Working pressures from 150 to 225 lbs. Max. length 50'.

AUROCHS AIR — For portable air compressors, jackhammers, rugged industrial and construction work. Smooth, black, non-porous tube resists heat and oil. Carcass: multiple ply, rubber-impregnated, rugged woven fabric. Tough black cover resists weather and abrasion. Stocked sizes: ½", ¾", 1". 200 lbs. working pressure. Maximum length 50'.



VIM AIR — For general industrial use, on compressors and pneumatic tools. Black tube resists oil and heat. Husky cotton yarn braids. Smooth, red cover resists weather, abrasion. 8 sizes stocked, ¼" 2-braid to 1" 3-braid. Working pressures: 150 to 225 lbs. Maximum length 500'.

BULL DOG VARI-PURPOSE AIR — For a variety of jobs including handling of air, water, oil, gasoline, kerosene (not for paints, lacquers, lacquer-solvents). Black, synthetic tube resists oil and heat. Carcass is braided rayon cord, high strength, super flexible. Smooth, brown, tough synthetic cover resists oil, abrasion, sunlight. 11 sizes stocked from 3/16" one-braid to 1" 2-braid. Working pressures: 200 to 300 lbs. Maximum length approximately 500'.

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Bovaird SUPPLY COMPANY

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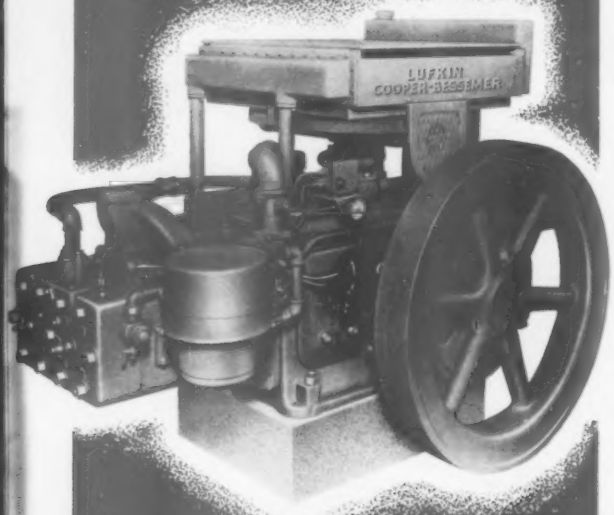
31 YEARS OF PROGRESS WITH THE OIL INDUSTRY

Lufkin



THE ENGINE OF MANY USES WHERE LOW MAINTENANCE, DEPENDABLE LONG LIFE SERVICE IS A NECESSITY

GSDH — 40-60 H. P.

Gas ENGINES

2 CYLINDER 2 CYCLE
400-600 RPM . . .

HORIZONTAL RADIATOR
FOR NON-DIRECTIONAL COOLING

●

2 CYLINDER 2 CYCLE
FOR SMOOTHNESS

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OIL COOLED PISTONS
FOR LONGER RING AND CYLINDER WEAR

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FULL PRESSURE LUBRICATION
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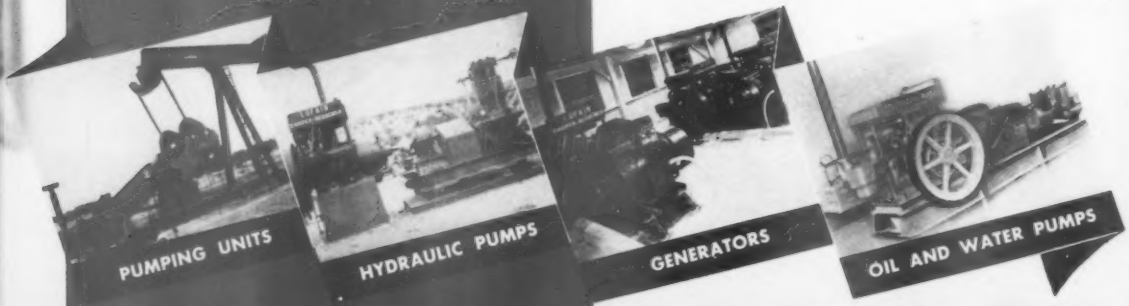
HEAVY DUTY CROSSHEAD CONSTRUCTION . . . . . .
FOR CONTINUOUS SERVICE



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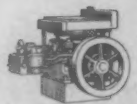
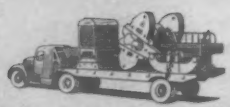
LUFKIN, TEXAS

Branch sales and service Houston, Dallas, New York, Tulsa, Los Angeles, Seminole, Oklahoma City, Corpus Christi, Odessa, Kilgore, Wichita Falls, Casper, Wyoming, Great Bend, Kansas.
Lufkin Equipment in CANADA is handled by
THE LUFKIN MACHINE CO., LTD. 14321 108th Avenue, Edmonton, Alberta, Canada.

LUFKIN PUMPING UNITS


LUFKIN-COOPER-BESSEMER ENGINES


LUFKIN OIL FIELD AND INDUSTRIAL TRUCK TRAILERS

INDUSTRIAL SPEED REDUCERS AND INCREASERS

DIVISION LUFKIN FOUNDRY & MACHINE COMPANY INDUSTRIAL, MILL AND AUTOMOTIVE SUPPLIES

TRACKSON PIPE LAYERS... *in full command* OF PIPE LAYING OPERATIONS!

Tremendous line pull provides ample lifting-lowering power . . . heavy-duty, automotive-type transmission has a speed for every job . . . convenient, fast-acting controls respond immediately to operator's touch . . . free-running boom and load line drums have individual clutches and brakes for accuracy and safety.

These exclusive Trackson **PIPE LAYER** features keep pipe laying operations under precision control at all times.

Let these features ring up extra profits for you . . . let Trackson **PIPE LAYERS** put down your pipe faster, safer and more accurately. Ask your "Caterpillar" Dealer about the model that fits your jobs . . . or write direct.

CATERPILLAR TRACTOR CO.
Peoria, Illinois

o Texas Pipeline Contractors, Fort Worth, Texas, lower in with a Trackson MDW8 PIPE LAYER on an offset DB. The MDW8 is one of five PIPE LAYER models.

TRACKSON
A SUBSIDIARY OF CATERPILLAR

TRAXCAVATORS®
TRACLOADERS
PIPE LAYERS
ANGLEFILLERS

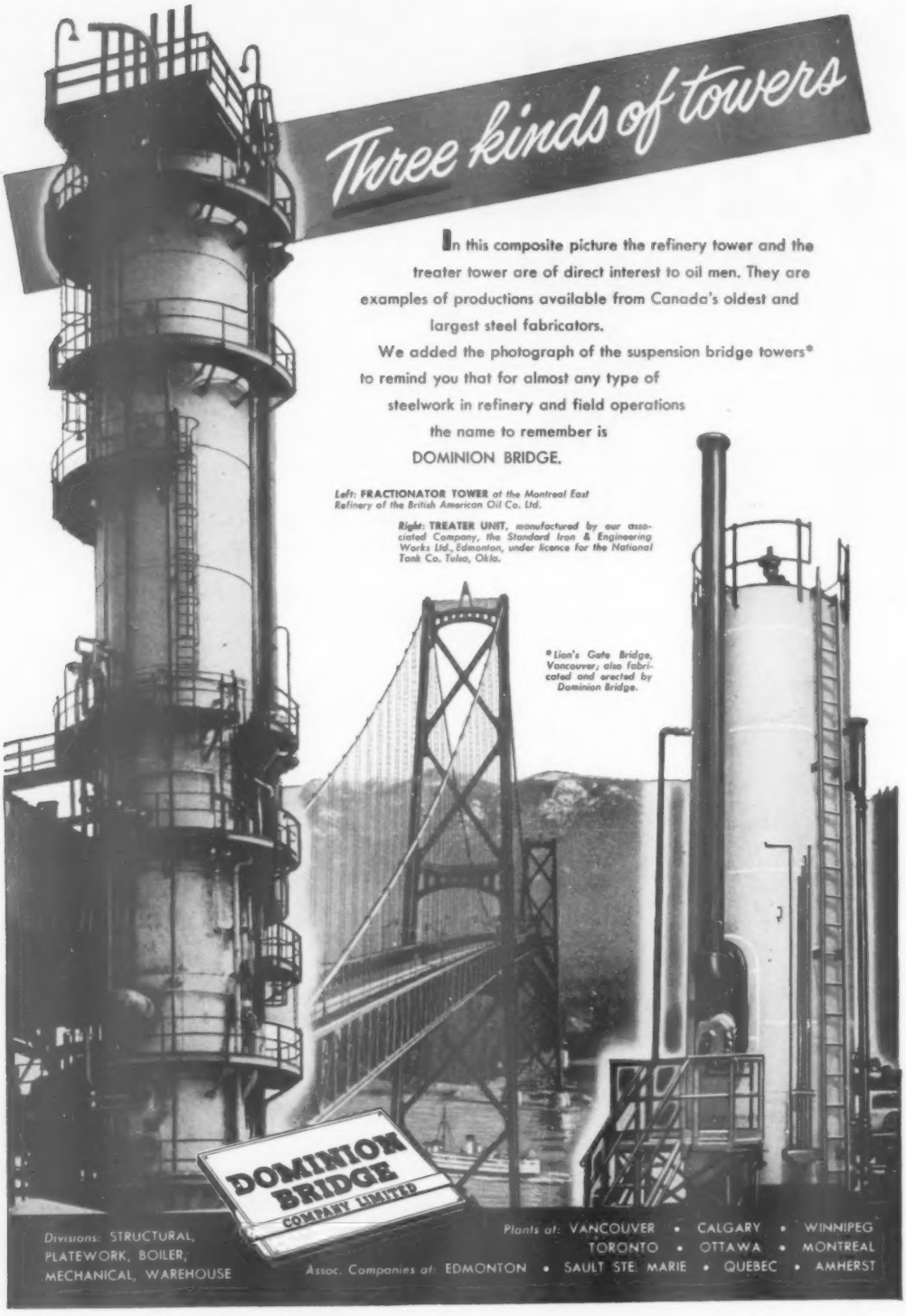
Three kinds of towers

In this composite picture the refinery tower and the treater tower are of direct interest to oil men. They are examples of productions available from Canada's oldest and largest steel fabricators.

We added the photograph of the suspension bridge towers* to remind you that for almost any type of steelwork in refinery and field operations the name to remember is DOMINION BRIDGE.

Left: **FRACTIONATOR TOWER** *at the Montreal East Refinery of the British American Oil Co. Ltd.*

Right: **TREATER UNIT,** *manufactured by our associated Company, the Standard Iron & Engineering Works Ltd., Edmonton, under licence for the National Tank Co. Tulsa, Okla.*



**Lion's Gate Bridge, Vancouver, also fabricated and erected by Dominion Bridge.*

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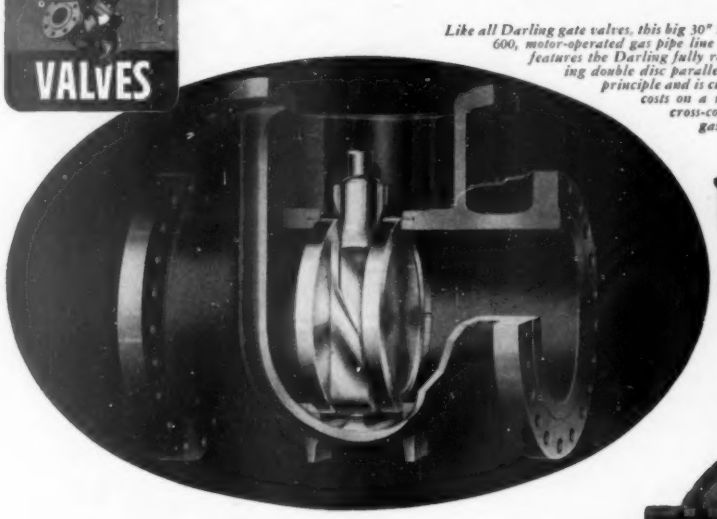
DARLING VALVES

FOR PLUS VALUES, JOB-PROVED AGAIN AND AGAIN



Like all Darling gate valves, this big 30" Series 600, motor-operated gas pipe line valve features the Darling fully revolving double disc parallel seat principle and is cutting costs on a major cross-country gas line.

IN NATURAL GAS TRANSMISSION LINES . . .

this Darling gate valve principle PAYS OFF!

TODAY you can avoid a lot of the costly, time-wasting valve trouble normally caused by temperature extremes and line stresses. Darling gate valves . . . *with their fully revolving double disc parallel seat principle* . . . are proving this on line after line.

This unique feature automatically compensates for valve body distortion, assuring *tight closure every time.* What's more, it means *uniform* distribution of disc and seat wear. The pay-off —less trouble, longer valve life, far less maintenance!

SEND FOR DATA

It will pay you to get better acquainted with Darling parallel seat gate valves. They come in a wide range of sizes and types for all gas and oil line requirements. Just outline your particular service needs or ask for a complete descriptive bulletin.

DARLING VALVE & MANUFACTURING CO.

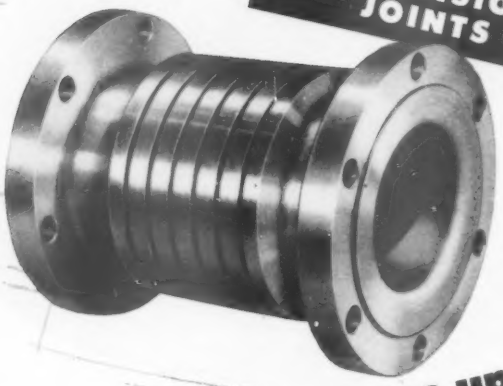
Williamsport 1, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ontario

FLEXONIFLEX

High Pressure

EXPANSION JOINTS



Flexonics engineered for pressures up to

5500 psi!

The Flexonics Expansion Joint Design Guide offers helpful data on the selection and application of expansion joints for all services. Write for your copy, today.

With its Flexoniflex line of expansion joints, Flexonics Corporation offers the first practical, in-line expansion joint for high pressure piping systems. Depending upon size and temperature, Flexoniflex units will handle pressures from vacuum to 5500 psi. Temperatures from –400° F. to 1600° F. can be accommodated at reduced pressure at the temperature extremes. Sizes range from ½" pipe through 6" pipe. Consult Flexonics Corporation's Engineering Department for information on larger sized units.

In construction, Flexoniflex units consist of one or more plies of corrugated stainless steel with integral control rings. They are available with either flanged or welding ends.

If you have high pressure piping we would like to show you how Flexoniflex Expansion Joints can solve your expansion control problems.

Flexonics *Corporation*

FLEXON BELLOWS DIVISION

1345 S. THIRD AVENUE · MAYWOOD, ILLINOIS

FORMERLY CHICAGO METAL HOSE CORPORATION

Flexon identifies products of Flexonics Corporation that have served industry for over 50 years.

Manufacturers of Convoluted and Corrugated Flexible Metal Hose in a Variety of Metals • Expansion Joints for Piping Systems • Stainless Steel and Brass Bellows • Flexible Metal Conduit and Armor • Assemblies of These Components

In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

'Round the Clock Servicing Helps Keep 'Em Rolling!

North American operates five strategically located car shops for servicing the many tank cars leased to the petroleum industry. We're striving now, as always, to keep our cars in good condition for maximum availability . . . keeping 'em rolling every minute possible through 'round the clock servicing. This is just one way North American is working to minimize the present critical car shortage and to better serve petroleum shippers these busy days.

For Special Products Requiring Special Care

NORTH AMERICAN CAR CORPORATION

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A NATIONWIDE ORGANIZATION WITH BRANCH OFFICES IN IMPORTANT MARKET CENTERS

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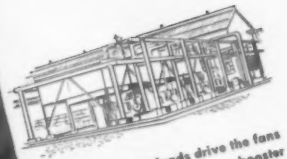
91 SOUTH MAIN STREET, FOND DU LAC, WIS. 739 PILLSBURY AVENUE, ST. PAUL 4, MINN.



These four Clevelands drive the fans in jacket water coolers at a booster station picking up flare gas. Installed at the Alma, Oklahoma, plant of a well-known oil company. Scores of similar installations are in service in the petroleum industry.

CLEVELAND CU units drive jacket water coolers

THE CU unit is a vertical worm gear drive designed especially to operate the fans of cooling towers. Widely used throughout industry, it is of particular interest to oil and gas producers and refiners.

Extreme conditions of heat, humidity and dust do not interfere with the dependable performance of this Cleveland drive. It carries high thrust loads and high radial loads with maximum efficiency. It lends itself to rugged mounting and is easily installed, serviced and adjusted in the field. Every unit is run in and pretested under load before it leaves the factory. And the experience of hundreds of users demonstrates that it operates quietly and continuously, at high speeds and for long periods.

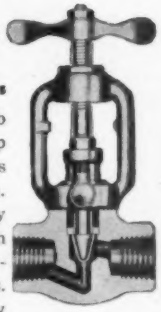
For full description and engineering data on the Type CU drive, write for Bulletin 135. Also available is a big new catalog (No. 400) of the complete Cleveland line of worm gear speed reducers. Ask for it on your letterhead. The Cleveland Worm and Gear Company, 3286 East 80th Street, Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Limited.

LOOK INTO *Edward* FORGED STEEL VALVES

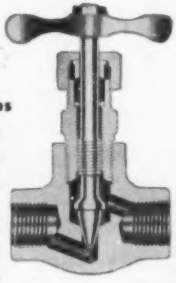
For Design Features That Keep Costs LOW – Performance HIGH

Edward
INSTRUMENT VALVES
Fig. 952-3 Series



Ratings of 6000 lb WOG or 1500 lb sp at 1000 F, in sizes ¼ in. through 1 in. A compact, heavy duty valve with many extraordinary features. Drop forged body and yoke. Tapered 13% chromium stainless steel needle-type integral or swivel stem-disk. O. S. & Y. No bonnet joint—swing bolted gland. Screwed or socket welding ends—globe and angle types. Carbon steel or 13% chromium stainless steel body.

Edward
GAGE VALVES
Fig. 152-3 Series



Ratings of 4000 lb WOG or 600 lb sp at 750F, in sizes ⅛ in. through 1 in. Has special tapered body-bonnet thread joint in ⅛, ⅜ and ½ in. sizes so bonnet remains tight. Union bonnet in ¾ and 1 in. sizes. Carbon, 13% chrome or 18-8 stainless forged steel body—13% chrome stainless steel semi-needle disk. Female outlets and female and male inlets. Globe and angle types.

EDWARD STOP VALVES

Forged steel. 600 and 1500 lb sp at 850F or 2000 and 3600 lb at 100F respectively. Globe and angle. Bolted or union bonnet. Screwed or socket welding ends. Stop, needle or stop-check types. Sizes ¼ to 2 inch inclusive.

Fig. 444

Edward Gives You:
THE NEWEST IN FLOW DESIGN

New flow design advantages are yours—thanks to years of Edward scientific flow research and development. Edward streamlined flow design reduces wear-producing turbulence—adds years of life to seats, disks, stems and other components.

MODERN DESIGN FEATURES

Throughout you'll find such features as non-porous, drop forged steel bodies; 13% chrome stainless steel disks, seats and stems; durable, heat-resisting packing; specially plated gland bolts; self-centering swivel plugs; and others to assure years of dependable service. Edward design also makes maintenance and accessibility to parts simple and foolproof. Write for catalog.

A Product of Edward Valves, Inc., 1492 West 145th Street, East Chicago, Ind.

YOU NEED THIS!

FOR COMPLETE INFORMATION on all Edward Steel Valves, write to Edward, Department CP, for 28 page comprehensive catalog #104, there's no obligation, of course.

Edward Valves, Inc.

Subsidiary of ROCKWELL MANUFACTURING COMPANY

EAST CHICAGO, INDIANA

the best

insurance against drill stem failure

Continual repeat orders from satisfied users testify to the unexcelled performance of CP DRILL COLLARS and TOOL JOINTS.

CP DRILL COLLARS are always of uniform hardness; perfectly straight and free from distortion strains because of special heat treatment processes; bored on machines developed expressly for Chicago Pneumatic; and finish turned on the outside so as to be concentric with the bored hole.

The pipe threading on CP TOOL JOINTS—cut after heat treatment to [illegible] all [illegible] of the highest accuracy. Counterbore welding assures the removal of point of stress from the last engaged thread. Finally each Tool Joint make-and-break thread has to meet a water pressure test of 2000 pounds per square inch to make certain the threading is absolutely watertight.

All popular sizes of CP DRILL COLLARS and TOOL JOINTS are carried in stock for prompt delivery.

CHICAGO PNEUMATIC TOOL COMPANY

MANUFACTURED AT FRANKLIN, PA.

GENERAL OFFICES: 6 EAST 44th STREET, NEW YORK 17, N. Y.

Oil Tool Division Office: One N. W. 16th Street, Oklahoma City, Oklahoma

In Canada: 10103 81st Avenue, So. Edmonton, Alberta, Canada • In Mexico: Mexico, D. F., Rosas Moreno No. 41; Tampico, Tamps., Apartado No. 174. Special Oil Tool Export Agent: E. F. Gahan, Inc., 500 Fifth Ave., New York 17, N. Y. (West Indies, Central and South America, exclusive of Mexico)

ALUMINUM MONEL* BRASS STEEL

NEED METALS?

INCONEL* STAINLESS STEEL NICKEL*

COPPER

Sheet, Plate, Tube, Pipe, Wire, Rod and Bar, Extrusions, Structural Shapes . . and the following INDUSTRIAL PRODUCTS: Fasteners, Tube Fittings, Pipe Fittings, Valves, Silver Brazing Alloy, Welding Material, Solder, Castings, Tube Expander Equipment, Liquid Plastic Protective Coating, Metallic Caulking Compound, Aluminum Metal Trim, Waterproof Barriers, Nails, Handrail Fittings, Low Melting Alloys, Aluminum Jacketing, Wire Cloth and Rope, and "O" Rings.

Precision Equipment for Shearing and Slitting.

*Not stocked in Kansas City or St. Louis territories.

IN THIS AREA?

THEN CALL:

METAL GOODS CORPORATION

OFFICES AND WAREHOUSES†

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Tulsa 3, Oklahoma
302 North Boston
Scott J. Harrison
Phone: 4-1175

Houston 3, Texas
711 Milby Street
Harris T. Gregg
Phone: CEntral 8881

Denver 2, Colorado
2425 Walnut Street
Cornelius C. Deke
Phone: AComa 5891

Dallas 9, Texas
6211 Cedar Springs Rd.
Sam D. Hodgdon
Phone: ELmhurst 3271

New Orleans 12, La.
432 Julia Street
Carl T. Wedemeyer
Phone: CAnal 7373

SALES SERVICE OFFICES

Jackson, Mississippi
781 Raymond Road
George E. Aberberg
Phone: 5-2711

Wichita, Kansas
2200 East Central
Ray Noller
Phone: 7-8921

Call, wire, or write nearest Metal Goods Corporation Representative:

Decatur, Illinois
1305 West Sunset
Fred Greer
Phone: 8-1314

Baton Rouge, Louisiana
4419 Mimosa Street
Paul P. Vidovic
Phone: LOuisiana 4-4738

Shreveport, Louisiana
3656 Beckham Drive
E. H. Currie, Jr.
Phone: 8-9281

Memphis, Tennessee
713 Columbian Mutual Tower Bldg.
Robert W. Downs
Phone: 5-8721

Davenport, Iowa
924 State Street
Robert L. Tharp
Phone: 2-3156

Omaha, Nebraska
3515 No. 67th Avenue
C. M. Cooley
Phone: Walnut 1112

Beaumont, Texas
238 Bowie Bldg.
L. T. Dodson
Phone: 4-6212

Fort Worth, Texas
3821 Caralyn
John M. Turbitt
Phone: WEbster 0477

San Antonio, Texas
2012 Alamo Natl. Bldg.
Roy D. Bagaley
Phone: GArfield 3161

General Offices: St. Louis 15, Missouri

Let's get down to "brass tack" facts about

CHEVROLET

Advance-Design TRUCKS

CHEVROLET first in demand in value in sales

Fact No. 1

YOU PAY LESS TO BUY!

Get the price on the Chevrolet truck that's the right size, type and capacity for your work. You'll find that it lists for less than any other truck capable of doing the same job. Chevrolet has the lowest priced line in its field.

Fact No. 2

YOU SAVE ON COST PER MILE

You can't beat Chevrolet's Valve-in-Head engine for over-all economy—fuel, oil, upkeep. It just keeps rolling along. And extra-rugged frame, hypoid rear axle, and Flexi-Mounted cab mean longer life, lower maintenance.

Fact No. 3

YOU GET THE RIGHT TRUCK FOR THE JOB

No truck is worth the price if it doesn't get the job done—fast and sure. Chevrolet trucks are *factory-matched* to the payload, *factory-matched* to the job. There's a standard body and chassis, or chassis for special body, that's just right for your work.

Fact No. 4

YOUR TRUCK INVESTMENT IS SAFER!

Comes time to trade in an old Chevrolet truck for a new one, here's good news: Year after year, used Chevrolet trucks traditionally bring more money compared to what they cost, than other makes. The demand is there, because Chevrolet trucks stand up better.

CHEVROLET ADVANCE-DESIGN TRUCK FEATURES

TWO GREAT VALVE-IN-HEAD ENGINES—Loadmaster or the Thriftmaster—to give you greater power per gallon, lower cost per load • POWER-JET CARBURETOR—for smooth, quick acceleration response • DIAPHRAGM SPRING CLUTCH—for easy-action engagement • SYNCHRO-MESH TRANSMISSION—for fast, smooth shifting • HYPOID REAR AXLE—for dependability and long life • TORQUE-ACTION BRAKES—on light-duty models • PROVED DEPENDABLE DOUBLE-ARTICULATED BRAKES—on medium-duty models • TWIN-ACTION REAR BRAKES—on heavy-duty models • DUAL-SHOE PARKING BRAKE—for greater holding ability on heavy-duty models • CAB SEAT—with double-deck springs for complete riding comfort • VENTI-PANES—for improved cab ventilation • WIDE-BASE WHEELS—for increased tire mileage • BALL-TYPE STEERING—for easier handling • UNIT-DESIGNED BODIES—for greater load protection • ADVANCE-DESIGN STYLING—for increased comfort and modern appearance.

CHEVROLET DIVISION OF GENERAL MOTORS, DETROIT 2, MICHIGAN

LADISH

Controlled Quality

PIPE FITTINGS

reduce piping assembly time

Makeup goes smoother... with less chance for delay... on those piping systems where Ladish fittings are installed. Ladish Controlled Quality makes the difference. By exacting controls over materials and manufacturing processes... Controlled Quality assures uniform weldability through metallurgical integrity, fast assembly through dimensional accuracy and provides a real assurance of ultimate operating economy and complete dependability... reasons why it pays to specify LADISH.

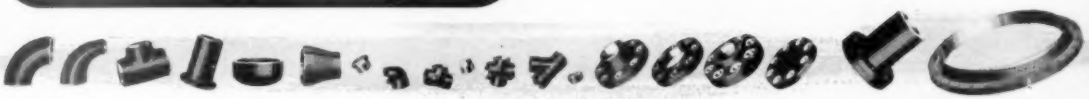
TO MARK PROGRESS

THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

LADISH CO.

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago • St. Paul
St. Louis • Atlanta • Houston • Tulsa • Los Angeles • Havana • Toronto • Mexico City



LLOYD M. URBAN, *Party Chief, came to work at Independent from Rice Institute. He began his practical field training as helper on a survey party, and has progressed with the Company for 15 years through the jobs that provide the experience background necessary for a party chief.*

Rely on Independent's Record . . .

20 years of successful exploration work

When you contract with Independent you can be certain that the men in charge of your work know how to get the job done. Independent is one of the oldest exploration contractors in the world operating continuously under the same ownership and management.

Independent crews have done successful surveys in 26 states and foreign countries. More than 100 important oil producers have found profitable satisfaction in the services of Independent Exploration Co.

Your inquiries are invited.

POINTING THE WAY FOR THE DRILL

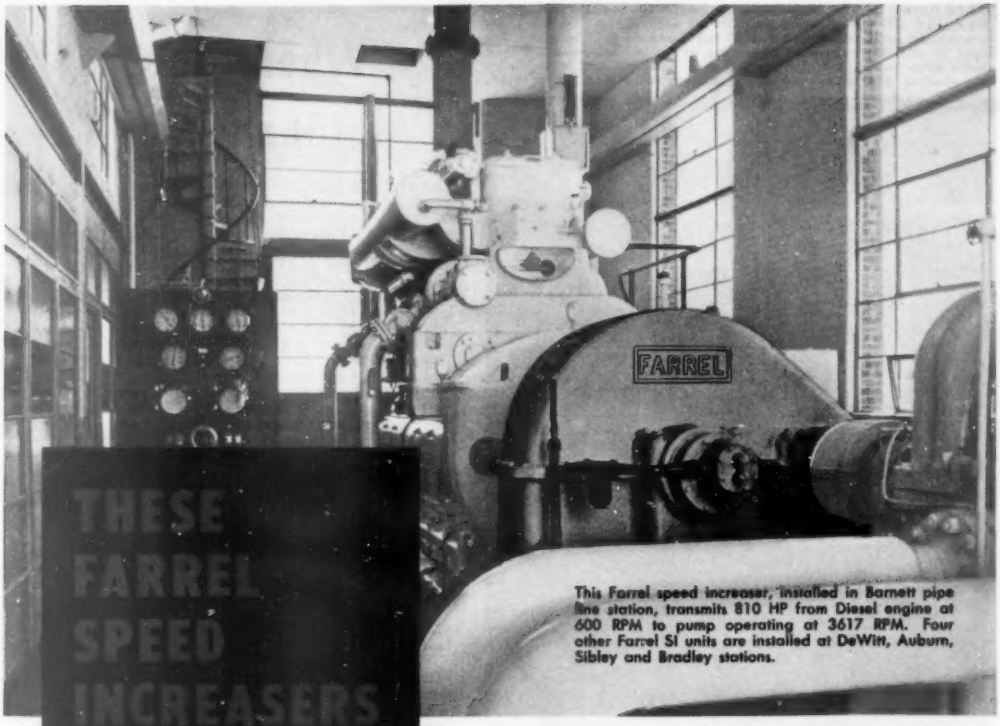
IXC

Independent *Geophysical Surveys*

EXPLORATION COMPANY

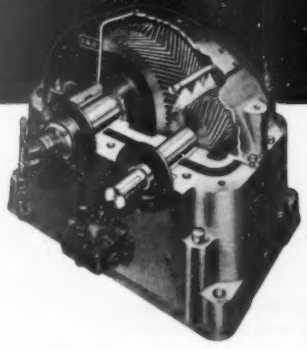
1973 WEST GRAY ★ HOUSTON, TEXAS

ESTABLISHED 1932



This Farrel speed increaser, installed in Barnett pipe line station, transmits 810 HP from Diesel engine at 600 RPM to pump operating at 3617 RPM. Four other Farrel SI units are installed at DeWitt, Auburn, Sibley and Bradley stations.

THESE FARREL SPEED INCREASERS WORK DAY AND NIGHT WITH ONLY ONE MAINTENANCE SHUTDOWN A YEAR



Five of these Farrel speed increasing units, installed in five different Illinois stations of Shell Products Pipe Line, have operated continuously, 24 hours a day, for more than five years, shutting down only once each year for routine inspection and maintenance or as required by pumping schedules.

Such outstanding performance is not unusual for Farrel speed increasers. Although hundreds and hundreds of these units have been furnished for pipeline pumping service, not one has ever failed on the job. In fact, every unit installed since 1932, when the line was first developed, is still operating successfully.

For further details of these proved-on-the-job speed increasers, send for a copy of bulletin 448A. No cost or obligation.

FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONNECTICUT

Plants: Ansonia, and Derby, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Boston, Pittsburgh, Akron, Detroit, Chicago, Minneapolis, Portland (Oregon), Los Angeles, Salt Lake City, New Orleans

OIL FIELD REPRESENTATIVES:
Hercules-Lupfer Engine Sales Co., 124 N. Boston St., Tulsa 1, Okla.
V. W. Osborne, 860-A M & M Bldg., Houston 2, Texas

F6-738

Farrel-Birmingham®

BALANCING A BUDGET comes naturally to Frank Wrenick of Evanston, Illinois, shown here with his wife, Sarah. Frank is an accountant in the General Office of the Standard Oil Company. So that, in addition to helping keep track of the family finances, Frank helps keep good track of Standard Oil's finances. And here is how he explains what happened to the money we took in during 1951.

"Where does the money go?"

"Ever try to explain to your wife what happened to all the money you've earned in a year's time? Well, pleasant or not, reviewing expenditures is something every family has to contend with. And every business, too. I know. I'm in the accounting department of Standard Oil, and I've put in many an hour on the annual profit and loss statement for Standard Oil and its subsidiary companies. I've found that the problems of company finances are a lot like personal financial problems.

"Like you, we took in a certain amount of money during 1951. In our case, $1,764,930,319 to be exact. And here's what happened to it . . .

"Over half, or 58%, represented the cost of things we had to buy such as crude oil, materials, and services, plus charges made for wear and tear. A great deal of the money we spent went eventually into the payrolls of the thousands of companies who supply us—and so helped maintain many other businesses in thousands of communities.

"Our next biggest item at Standard—even bigger than our payroll—was for taxes. In fact, 19.1% of what we took in was paid out in taxes, including our own taxes and those we collect from our customers for national, state and local governments. And that figure does not include the many 'hidden' taxes which both you and we pay!

"Wages, salaries and benefits for our 49,700 employees accounted for 14.5% of what the company took in.

"At this point, all costs of doing business have been taken care of. And here's what happened to the remaining 8.4% of the money . . .

"We used 5.9% to improve our service to our customers, through investment in oil wells, refineries, service stations, etc.

"The balance, or 2.5% was paid in dividends to Standard Oil's 116,800 stockholder-owners, including over 24,000 of us who are employees.

"Everything considered, it was a good year. That's where all the money went and we feel sure you'll agree it was used to serve you well."

Standard Oil Company (INDIANA)

MONEY WELL SPENT assures good wages and steady work for our 49,700 employees—one of whom is Preston Chalk of our Wood River, Illinois, refinery. In recent years, two-thirds of our profits have been plowed back into the business, so that today each Standard Oil employee is backed by an average investment of $31,400 in tools and equipment, which helps him to produce more, earn more and have steadier work.

MONEY WELL SPENT assures a fair return on the investment of S. Dexter Hastings of Green Bay, Wisconsin—one of our 116,800 stockholder-owners. Last year our stockholders received dividends equal to 2.5% of what we took in. No one individual owns so much as 1% of our stock. No one of the institutional owners, including many educational and charitable organizations, owns so much as 4% of our stock.

MONEY WELL SPENT assures more progress in helping dealers like Ralph Nolan keep customers like Raymond Morris rolling. The many thousands of independent businessmen who are Standard Oil dealers offer you quality petroleum products at reasonable prices. Gasoline, for example, now sells at approximately 1925 prices; (only the tax is higher). Yet, two gallons today do the work that then took three.

The third in the 1952 series of Standard Oil interpretive advertisements tells what happened to the money the company took in during 1951.

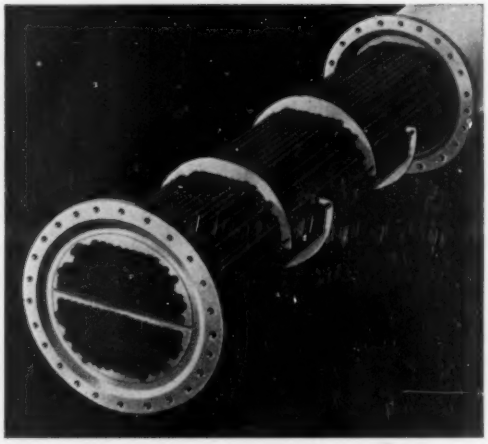
How to Cut Down Shutdowns

Anyone engaged in the refining industry, which works continuously around the clock, knows that shutdowns are expensive.

The one thing that will help reduce these shutdowns is more care exercised in the selection of materials that go to make up the equipment. Every part must function with dependability. And what part demands more dependability than the condenser tubes?

The condenser tubes that are recognized everywhere for their unquestioned dependability are Wolverine seamless, nonferrous tubes—the tubes that are quality controlled from ore to finished product.

These condenser tubes are available in any copper alloy that you may require to meet your particular conditions. Our engineers are always ready to consult with you on the most suitable alloy to use in your particular application.



WOLVERINE TUBE DIVISION
Calumet & Hecla Consolidated Copper Company
INCORPORATED
Manufacturers of seamless, nonferrous tubing
1459 CENTRAL AVENUE • DETROIT 9, MICHIGAN

PLANTS IN DETROIT, MICHIGAN AND DECATUR, ALABAMA
Sales Offices in Principal Cities

Export Department, 13 E. 40th St., New York 16, N. Y.

Two ways the new Taylor

1. BY THESE DISTINCTIVE FEATURES:

2. Change from direct to reverse action is made easily, quickly by rotating top plate without disturbing any pipe connections.

1. Single knob adjustment of both proportional and reset control responses provides simple, quick stability "tune-in".

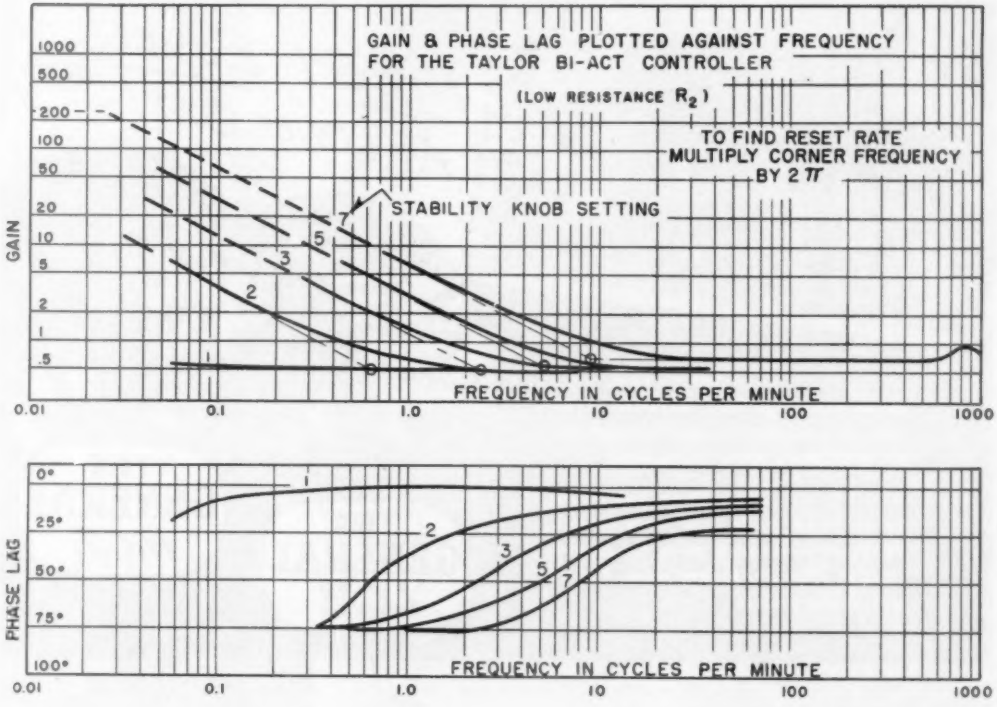
3. Plug-in manifold, with self-sealing valves, provides simple means for connecting or removing controller without disturbing pipe connections (optional).

5. Cover plate protects control knob from elements, damage, and tampering.

4. Integral cut-off relay on every Bi-ACT unit permits panel or field mounting.

to describe Bi-Act* Controller

2. BY FREQUENCY RESPONSE ANALYSIS:



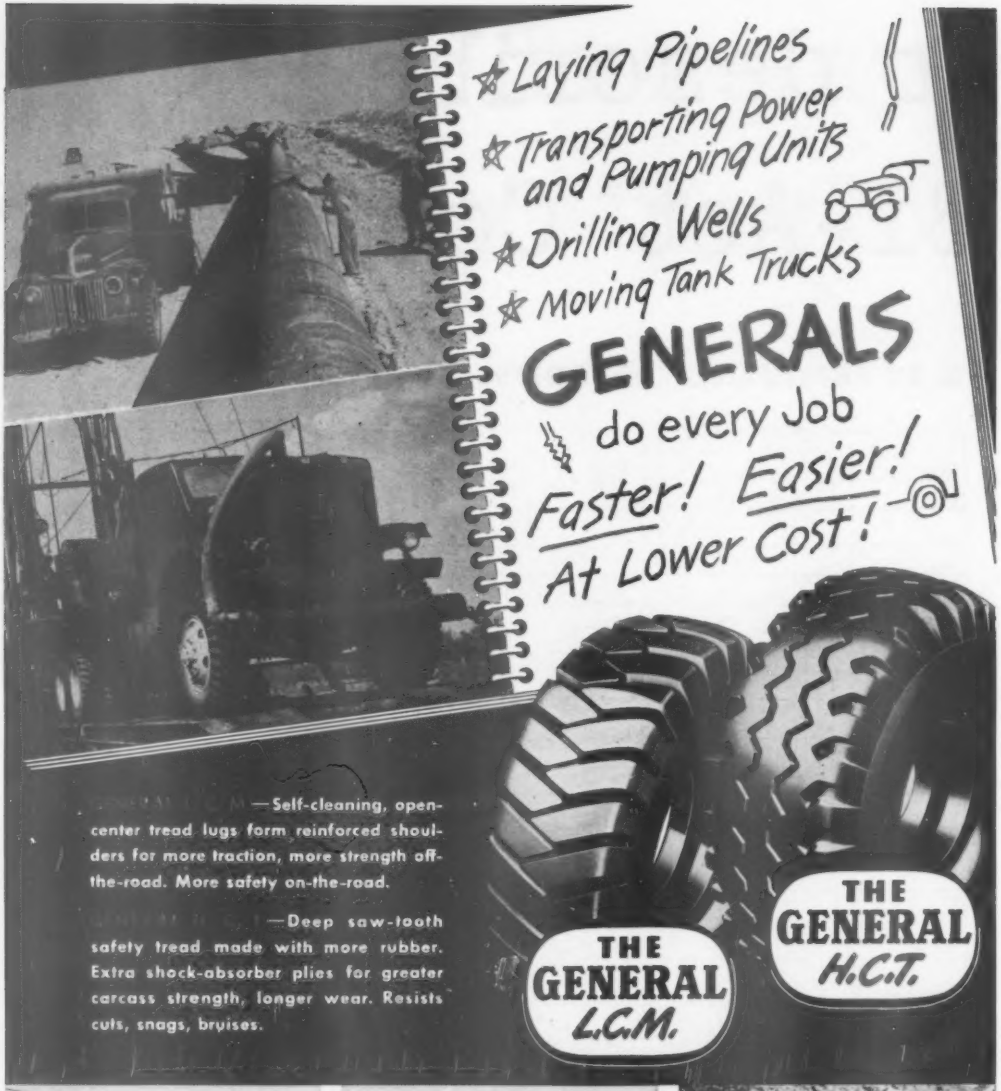
* Trade-Mark

The above graphs describe the BI-ACT Controller designed for use in industrial processes with short time lags such as close-coupled liquid flow, fast pressure and comparable temperature problems.

Send for Bulletin 98097 describing the TRANSET Control System, or any of the following papers: "**Frequency Response Analysis**" . . . "**Frequency Response Data on BI-ACT Controllers**"

Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada. *Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.*

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY


☆ Laying Pipelines
☆ Transporting Power and Pumping Units
☆ Drilling Wells
☆ Moving Tank Trucks
GENERALS
do every Job
Faster! Easier!
At Lower Cost!
—Self-cleaning, open-center tread lugs form reinforced shoulders for more traction, more strength off-the-road. More safety on-the-road.
—Deep saw-tooth safety tread made with more rubber. Extra shock-absorber plies for greater carcass strength, longer wear. Resists cuts, snags, bruises.
THE GENERAL L.C.M.
THE GENERAL H.C.T.

GENERAL ALL-GRIP — For lighter trucks, the General All-Grip's sturdy tread blocks give extra traction on unimproved roads.

GENERAL NON-DIRECTIONAL CLEATED—Extra traction forward or backward on this broad lugged, self-cleaning tread. Best for dump trucks.

GENERAL INDUSTRIAL PNEUMATICS — Wide-base small tires for extra cushioning, more flotation. Extra protection for equipment.

SPECIFY GENERAL TIRES ON YOUR NEW EQUIPMENT

in WIRE ROPE, too specialized use calls for the RIGHT KIND of muscle

Tough, wiry muscles stand the Rocky Mountain Bighorn in good stead; give him the sure-footed agility he must have to survive on almost impassable heights.

In wire rope, too, the right kind of muscle is mighty important... because different uses present different problems of wear and tear. Bending fatigue. Abrasion. Shock stress. Load strain. Each requires wire rope with the right construction and lay; the right grade of steel and size of wire to best withstand the destructive forces encountered.

Complete quality control from ore to finished rope; long experience and specialized know-how—these are your assurance that in Wickwire Rope you always get the proper combination of physical properties for long-lasting, reliable service on your particular job.

WICKWIRE ROPE
A CF&I PRODUCT

LOOK FOR THE YELLOW TRIANGLE ON THE REEL

THE COLORADO FUEL & IRON CORPORATION—Abilene (Tex.) • Denver • Houston • Odessa (Tex.) • Phoenix • Salt Lake City • Tulsa
THE CALIFORNIA WIRE CLOTH CORPORATION—Los Angeles • Oakland • Portland • San Francisco • Seattle • Spokane
WICKWIRE SPENCER STEEL DIVISION—Boston • Buffalo • Chattanooga • Chicago • Detroit • Emlenton (Pa.) • New York • Philadelphia

WICKWIRE ROPE

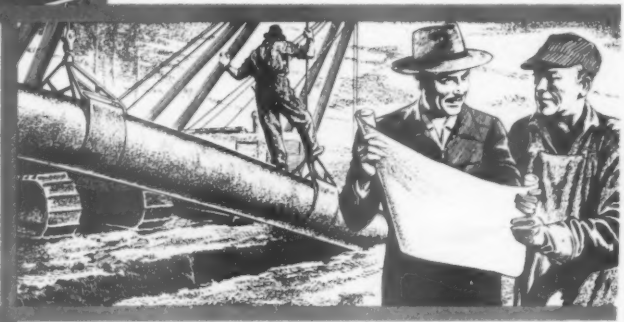
CF&I

PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL & IRON CORPORATION

For better pipe protection . . .
it pays to
keep BARRETT in the picture
all the way

In the planning stage,
you'll find it pays to call in a Barrett technical advisor. Take advantage—*right from the beginning of your job*—of Barrett's long years of experience in protecting America's greatest pipelines.

During the installation,
a Barrett Technical Service Representative is always available for on-the-job consultation. He'll help you save time and money. Remember: even the finest enamels must be properly applied for proper protection.



Throughout the operation—from start to finish,
make use of Barrett's Field Manual, which gives detailed procedures for proper application—from cleaning to back-filling. Yours for the asking.

Check these advantages of BARRETT* COAL-TAR ENAMELS

- *The right product and procedure for every gas and oil pipeline need*
- *Resistance to extreme atmospheric temperatures*
- *High ductility and flexibility*
- *High resistance to soil stresses*
- *High dielectric properties*
- *Moisture impermeability*
- *Resistance to gas and petroleum attack*
- *Easy availability and application*
- *On-the-job technical assistance*
- *Dependable deliveries*

Barrett

THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 RECTOR STREET, NEW YORK 6, N. Y.

In Canada:
The Barrett Company, Ltd., 5551 St. Hubert St., Montreal, Quebec

*Reg. U. S. Pat. Off.

String Saver...

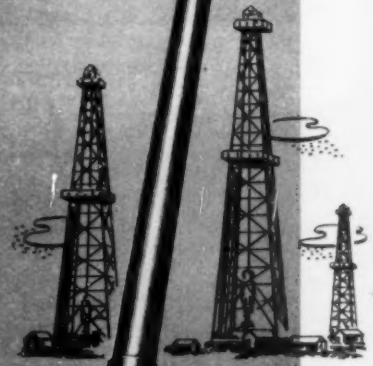
CASING, that is –

Set Your Casing String in a Producer

With the demand for oil and gas high, and the supply of casing low, don't take a chance on losing a string of casing in a dry hole. The Johnston Open Hole Tester can save that string of casing for you by determining your well's productive possibilities.

The dependability of this Tester has been proved in thousands of tests — shallow and deep. It will get the information in your well, too.

With the Johnston Open Hole Tester, you know for sure. When it's time to test — call Johnston. Experienced representatives operate in all active areas — twenty-four hours a day.



JOHNSTON TESTERS, INC.

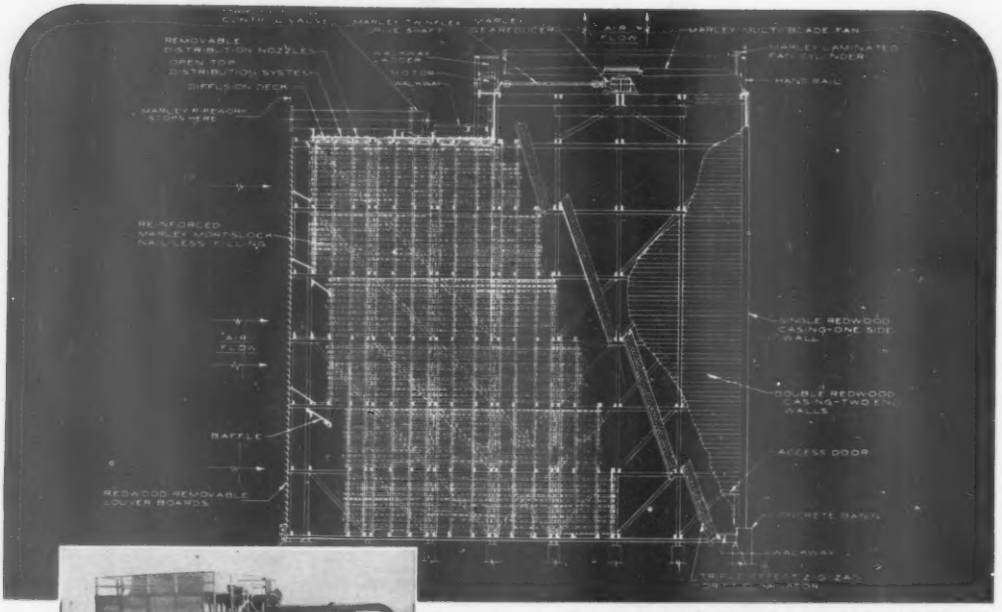
5702 NAVIGATION BLVD. • HOUSTON, TEXAS

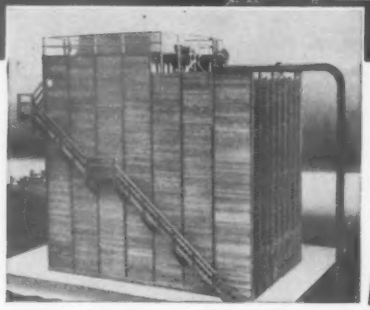
EXPORT DIVISION: 3035 Andrita St. Los Angeles 65, California

SERVICE BRANCHES IN ALL ACTIVE AREAS

There's a Johnston Service Representative Near You

FORMATION AND CASING TESTING — JOHNSTON





for MAXIMUM PERFORMANCE with NARROW PLAN AREA

Engineers who know, choose MARLEY Single-Flow

SINGLE-FLOW COOLING TOWERS adapt Marley patented cross-flow water cooling to confined areas, retaining the features that have built and maintained Marley leadership in industrial water cooling.

Some of these design features, such as the full-height louvered end-wall and patented Mortis-Locked filling are most fully utilized in Single-Flow design. That means greater air volume, more breakup, longer air-water contact—it means wide cooling range and close approach to wet bulb temperature.

Open, visible distribution with its many operational advantages is included in Single-Flow engineering. All mechanical equipment is Marley designed and Marley manufactured for cooling tower use exclusively.

The rugged structural strength and long-tested durability that characterize all Marley design are engineered into every Single-Flow tower. Ease of maintenance and safety of operation are functional features of these high performance towers.

Marley Application Engineers, located in fifty leading cities, will gladly give you further information on Single-Flow cooling towers.

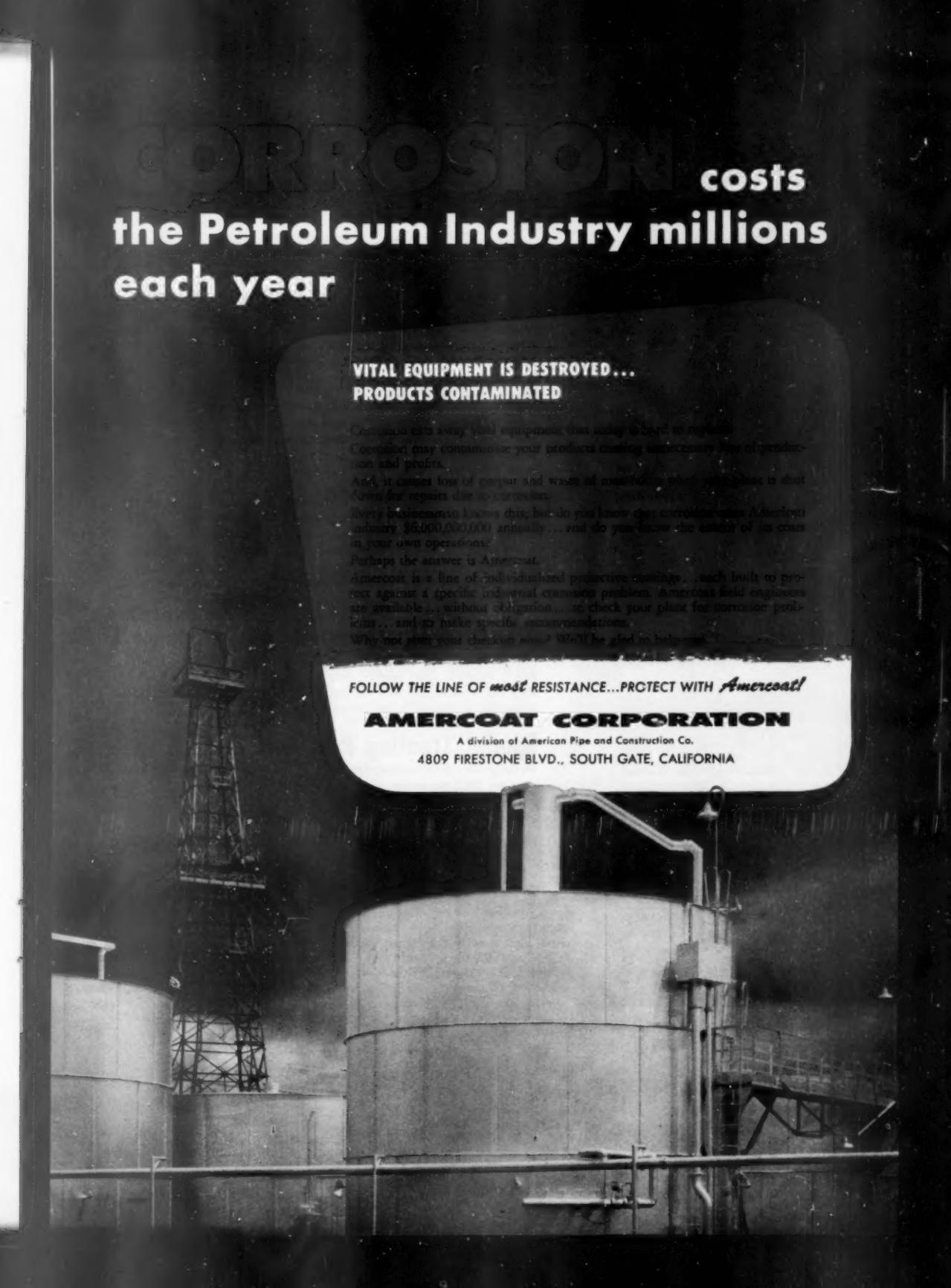
producers of

DOUBLE-FLOW TOWERS
AQUATOWERS
DOUBLE-FLOW AQUATOWERS
DRICOOLERS
NATURAL DRAFT TOWERS
CONVENTIONAL TOWERS
SPRAY NOZZLES

MARLEY

The Marley Company, Inc.

KANSAS CITY 5, MISSOURI


CORROSION costs
the Petroleum Industry millions
each year
VITAL EQUIPMENT IS DESTROYED...
PRODUCTS CONTAMINATED
FOLLOW THE LINE OF most RESISTANCE...PROTECT WITH Amercoat
AMERCOAT CORPORATION
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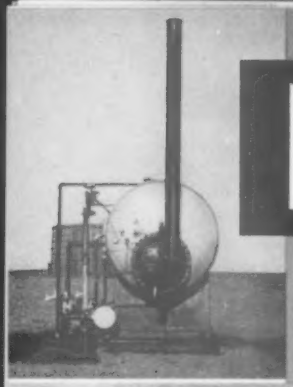
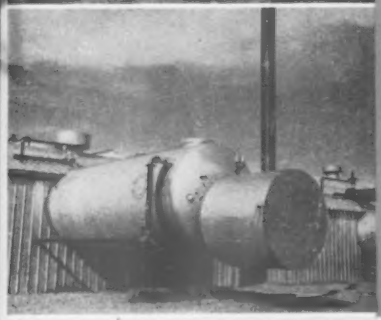


BS&B Horizontal are getting

in the NEBRASKA • KANSAS



Up where the wind blows cold and the snow drifts deep, BS&B Horizontal Emulsion Treaters are catching on fast. They're getting the job done for operators with hookup, housing and insulation, and special treating problems. Pictured here are some of the BS&B Horizontal Emulsion Treaters in operation in these fast developing oil patches.

Ease of Hookup Particularly in Nebraska, Colorado and Wyoming, leases are scattered, time is money and distance a factor. Here the ease and speed of hookup of the BS&B Horizontal Emulsion Treater is a very important feature to operators.

Convenient Housing Severe temperatures and variations make housing necessary for many installations. The BS&B Horizontal Emulsion Treater is easy to house. In this area moisture freezes in gas lines, causing gas operated dump valves to become inoperative unless properly insulated. Because dump valves are located close together on the BS&B Horizontal Treater, they are easily protected from freezing temperatures. Protector hood for burner is available as extra equipment.

Minimum Operating and Maintenance Costs
Operators are finding the New BS&B Horizontal Emulsion Treaters economical to operate. They realize, too, that as time goes on they will be easy to keep clean, paint and maintain because they're easily accessible. Costly, routine inspection of firebox is not necessary.

Special Treating Problems In this area, water content varies greatly from lease to lease. Excessive water exists with many wells, and here the BS&B Horizontal is proving the value of its designing and engineering.

BS&B . . . for 60 years a leader in oil and gas producing and refining equipment . . . also manufacturers of Climax Controls, Safety Devices and special fabricated pressure vessels. Ask your BS&B Man. There's one of BS&B's 33 Branches or 13 Sales Offices near you if you're in the Oil Country . . . or write . . .

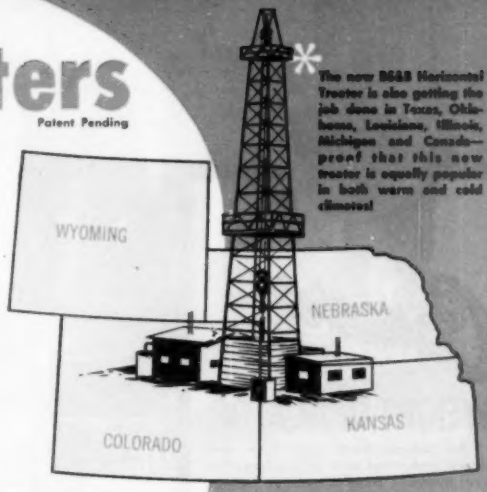
EFFICIENCY BS&B RELIABILITY

Emulsion Treaters

Patent Pending

the job done

COLORADO • WYOMING AREA*

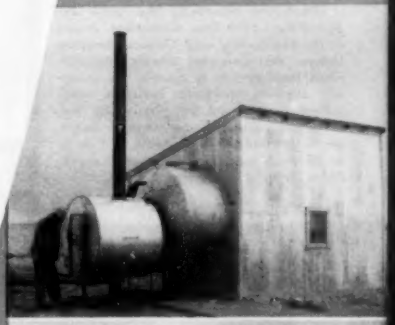


* The new BS&B Horizontal Treater is also getting the job done in Texas, Oklahoma, Louisiana, Illinois, Michigan and Canada—proof that this new treater is equally popular in both warm and cold climates!

Pipeline requirements are rigid as to water content, and the BS&B Horizontal Emulsion Treater is keeping the water content within the minimum. The treaters, in some cases, are handling several wells with different emulsion characteristics.

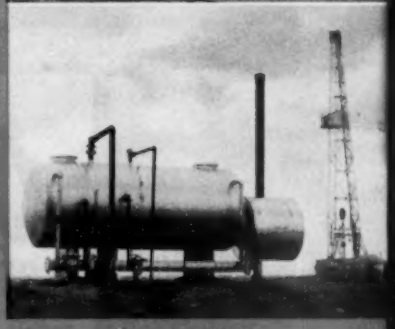
All Operators Like the Steam Chest

Regardless of location or type of oil being treated, all operators particularly like the steam chest . . . the big feature of the BS&B Horizontal Emulsion Treater. There is greater efficiency with direct heating of the emulsion—no wasteful heating of wash water. In the Kansas area particularly, where there is a high content of alkali, the steam chest solves one heretofore serious problem . . . fire box burnouts are practically eliminated. Because lower temperatures permit minimum heating of salt water, corrosion is reduced. Low skin temperatures on the steam chest minimize the chance of salt deposits and eliminate any possibility of "coking."



The New BS&B Horizontal Emulsion Treater Is Popular in Warmer Climates, Too

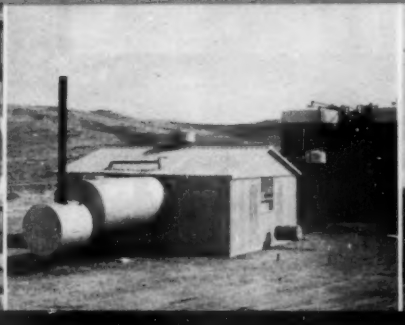
The BS&B Horizontal Emulsion Treater has been tried and tested in warmer climates, too. Operators are quick to recognize BS&B as being first with a steam chest for a horizontal emulsion treater. This is a closed system requiring no make-up water . . . it is removable . . . and it's built to A.S.M.E. requirements. The large, quiet free water knockout provides a larger surface for separation of free water . . . which is removed without being heated. Heat load on the heating unit is reduced. A higher gravity crude is possible with the large steam heating and settling section. Hot gas produced in this section is mixed with cool gas from the free water knockout section, causing the heavier gas fractions to condense and be recovered in the oil.

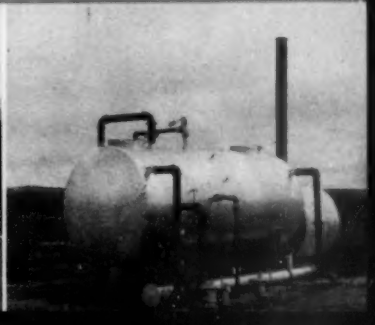


BS&B Horizontal Emulsion Treaters are available for delivery . . . Sizes 6'x14'—6'x21'—8'x21'—10'x21' . . . Auxiliary units available for attachment to the treater at factory or in field with minimum of time and effort.

BLACK, SIVALLS & BRYSON, INC.

Oil & Gas Equipment Division, Department 1-A5, 2131 Westwood Blvd., Oklahoma City, Oklahoma.





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THAT MAKE A BIG
DIFFERENCE
in RIG EFFICIENCY
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WEIGHT INDICATOR
The Cameron Weight Indicator is completely mechanical and is, therefore, free from hydraulic troubles such as leakage and temperature changes.
Employing essentially the same dependable, trouble-free mechanical design as the now widely used Cameron Pressure Gauge, the Cameron Weight Indicator reads load directly in pounds. Its unusually sensitive movement indicates small weight changes so that the driller can accurately maintain any desired weight on the bit. Instantly adjustable to 4, 6, 8, or 10 lines, any size. Extremely rugged. Roller bearing equipped throughout.
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The Cameron Pressure Gauge accurately indicates line pressures in big, clear figures and division marks that may be easily read from across the derrick floor. The self-contained pulsation dampening mechanism requires no adjustment for changes in pressure and gives uniformly steady pressure readings. All internal parts work in oil, thus eliminating corrosion and wear and cushion the dial against line vibrations.
Type "D" for rotary drilling rig service; type "F" for core drills, cementing and acidizing units, etc.
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The Cameron Shear-Relief Valve protects pumps, manifolds, drilling hose, etc., against excessive pressure. A common nail shears when pump pressure against the valve piston reaches the shear stress of the nail, releasing the flow of fluid through the valve outlet. The sheared nail is the only damaged part, and the valve is easily reset with another nail by any member of the crew . . . using directions on the valve name plate for nail size and the pressures at which each size shears.
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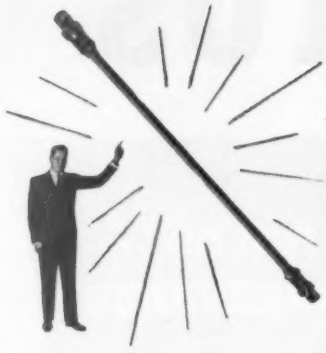

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JONES has a way of adding strength and fatigue resistance to selected steels. In a special machine, the peening action of thousands of round balls impart a condition of compression to a scale-free surface—smooth it for painting in the distinctive green compound.

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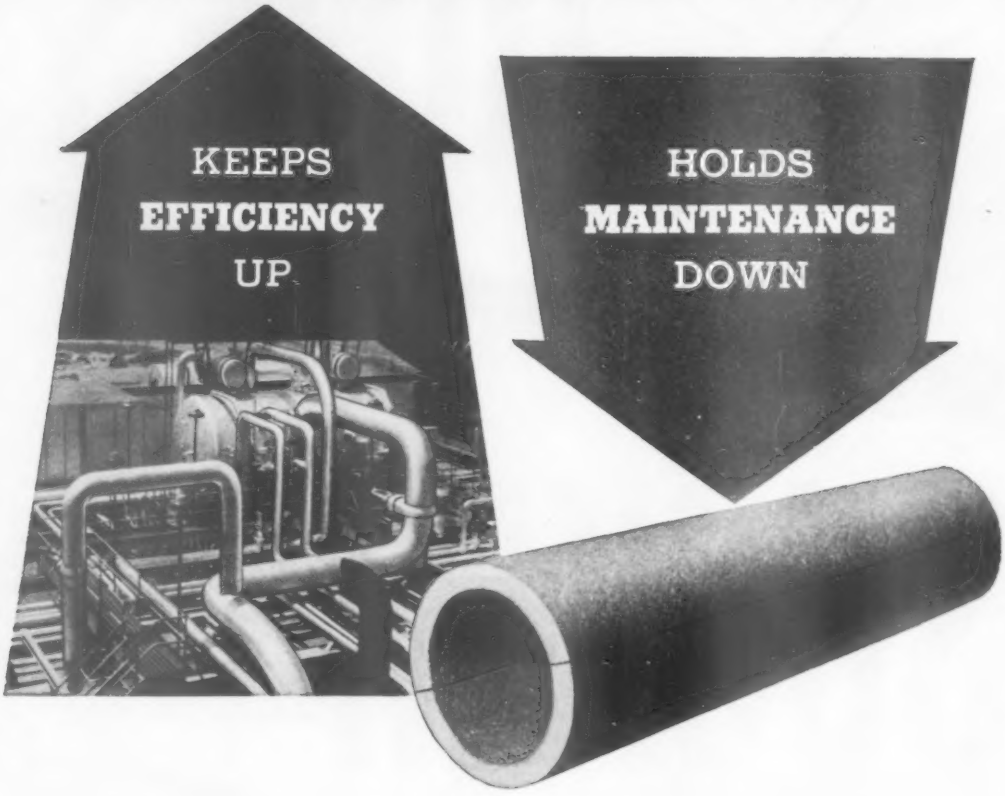

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Want to reduce heat-loss, surface temperature, and *maintenance costs*—all at the same time? You can, with Unibestos! And you can get stock delivery from your Unarco Distributor in cylinders, half-rounds, or blocks. When temperatures go as high as 1200° F., specify Unibestos No. 1200—and Unibestos No. 750 for up to 750° F., maximum. Or, where temperatures won't run over 600° F., ask for Unarco Amocel—it has many of the same excellent features. Unibestos and Amocel are easy to install, stay put, resist all service hazards.

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WHY AXELSON SUCKER RODS ARE LEADERS IN THE FIELD

For 60 years Axelson has been producing equipment for the Petroleum Industry. Specialized knowledge of the field and in techniques of manufacture make Axelson products natural leaders. Sucker rods are a case in point. Here are 13 steps in manufacturing procedure which lead to Axelson sucker rod quality.

STRAIGHTENING A perfectly straight bar is paramount in the manufacture of sucker rods. The first operation is done in a Medart bar straightener, after which, careful checks are made for kinks or bends. Bars are then trimmed to exact length.

FORGING Due to length of stock gathered for the upset, in comparison to the diameter of the rod, the upsetting of sucker rod ends is a very difficult operation. Holding the upset to size and shape is only part of the requirement. Steel, after being rolled, has a grain similar to that of wood, and, like wood, its strength is much greater when the load is taken in a direction parallel with this grain. For this reason, it is necessary to upset the rods in such a manner that this grain will deviate from a straight line as little as possible. This requires understanding of forging practice that can only be acquired by years of experience, combined with the latest scientific knowledge. Forging must be done with correctly designed dies on steel that is exactly at the proper temperature. The design of the furnaces used to heat the rods for forging is the result of years of effort to produce perfect results. Maintaining the temperature of these furnaces is not left in the hands of the operator, but is controlled by an automatic recording pyrometer.

IDENTIFICATION MARKS After the last forging operation, code letters and trademarks are stamped on the flat of the wrench square. This identification is kept as a complete record in the laboratory files making it possible to determine the whole history of the rod.

DESIGN OF THE ROD END The finished upset consists of the pin end and its shoulder, both with stock left for machining, the square, which must be smooth and to size so as to fit standard wrenches, and the lower shoulder which is tapered into the body of the rod. In the design of Axelson rod forgings, the change in section is a taper in which the metal is so distributed that any bending stress which may occur because of hole crookedness will be spread over as great a length of rod as possible, thereby eliminating excess stress concentration.

HEAT TREATING In this operation, the rods are heat treated the *full length* to insure uniform grain structure from end to end, and the best combination of strength, ductility, and shock resistance.

DESCALING Any ferrous material, when heated to temperatures necessary to accomplish the purpose of normalizing becomes encased in a thin covering of iron oxide. The removal of this scale is done by passing the rods through a shot blast cleaning machine of the continuous type. Removal of the scale exposes any rolling or forging defects, and at this time another inspection is made for straightness.

THREADING The rods are now transferred to the Threading Department where a battery of ram-type turret lathes is used for the machining. This equipment permits better control and supervision by the operator over each individual rod, producing greater uniformity and accuracy.

FINAL INSPECTION As the rods are rolled out on steel trestles to facilitate gaging, they are again carefully scrutinized to detect and eliminate any rods having rolling or forging defects. The thread protectors are then removed, gaging is done in accordance with gaging practice recommended by the American Petroleum Institute. A rust preventing grease is then applied to the finished pin end.

ASSEMBLING COUPLINGS TO RODS The rods are now placed on an assembly table, on one end of which is solidly attached a square socket. The need of screwing up sucker rod couplings sufficiently tight against the shoulder cannot be too greatly emphasized. Unless the sucker rod pins are pre-loaded by this means, beyond any load that will ever be applied in service, there will be a reversal of stress because of pumping motion, and also, if there is any misalignment because of hole crookedness, a bending moment will be imposed at the bottom of the thread causing severe stress concentration because of the "mechanical notch" effect of the thread, and a fatigue fracture will prematurely develop.

PAINTING Painting of the rods is a protective measure. It is accomplished by dipping in red Vinyl paint and drying under heat lamps.

STORAGE OF FINISHED RODS In placing the finished rods in the storage piles, plenty of blocking is used between bundles to prevent bending and to allow the rods to lie straight. The same care is taken in shipment.

ADDITIONAL CHECK TESTS Although there is a laboratory control on every step in the manufacture of Axelson sucker rods, additional tests are made regularly on the finished product. Forged ends that have been rejected because of machining defects are cut off and sent into the laboratory for physical tests. Still other forging specimens are prepared and tested in the fatigue machine and in the Izod Impact Machine.

FATIGUE TESTS ON FINISHED RODS A final fatigue test on finished rods concludes the manufacturing process. Two 4′ sub rods are joined together with a coupling in the usual manner and placed in a machine which puts them in tension approximating the peak load encountered in well service. Bending, hammering, and severe vibration constitutes this very severe test and gives the equivalent of lifetime of service to the rod.

THAT'S WHY IT'S

AXELSON

CHOSEN FIRST... TO LAST!

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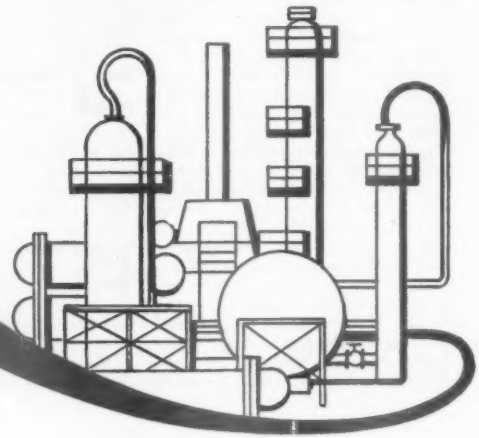
Kontol is a non-volatile, heat-stable, semi-polar organic corrosion preventive. It is soluble in most distillates and crude oils and is available in two forms, water-insoluble and water-emulsifiable. It protects against corrosive attack by adsorbing at metal surfaces in the form of a thin, impervious film, thereby preventing contact between corrosive elements and metals. Excellent protection has been attained when temperatures were as high as 300°F. Kontol is stable at temperatures up to 550° F plus.

Kontol has been effective in preventing corrosion in piping systems, pumps, fractionating towers, stripping columns, cooling water systems, heat exchangers and separators. Injected into a refinery system, Kontol continues to afford corrosion protection to all the metal surfaces it contacts, consequently, its protection action is extended downstream from the initial injection point.

The use of Kontol does not affect the properties of refined products, such as end point, gum formation, anti-knock rating, color, ash, etc.

If corrosion is causing lost on-stream time in your refinery, request a Tretolite Company corrosion rate survey. Such a corrosion survey is yours for the asking and entails no obligation. It may enable your refinery to substantially reduce corrosion losses. Why not request it today?



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CORROSION INHIBITING • DESALTING
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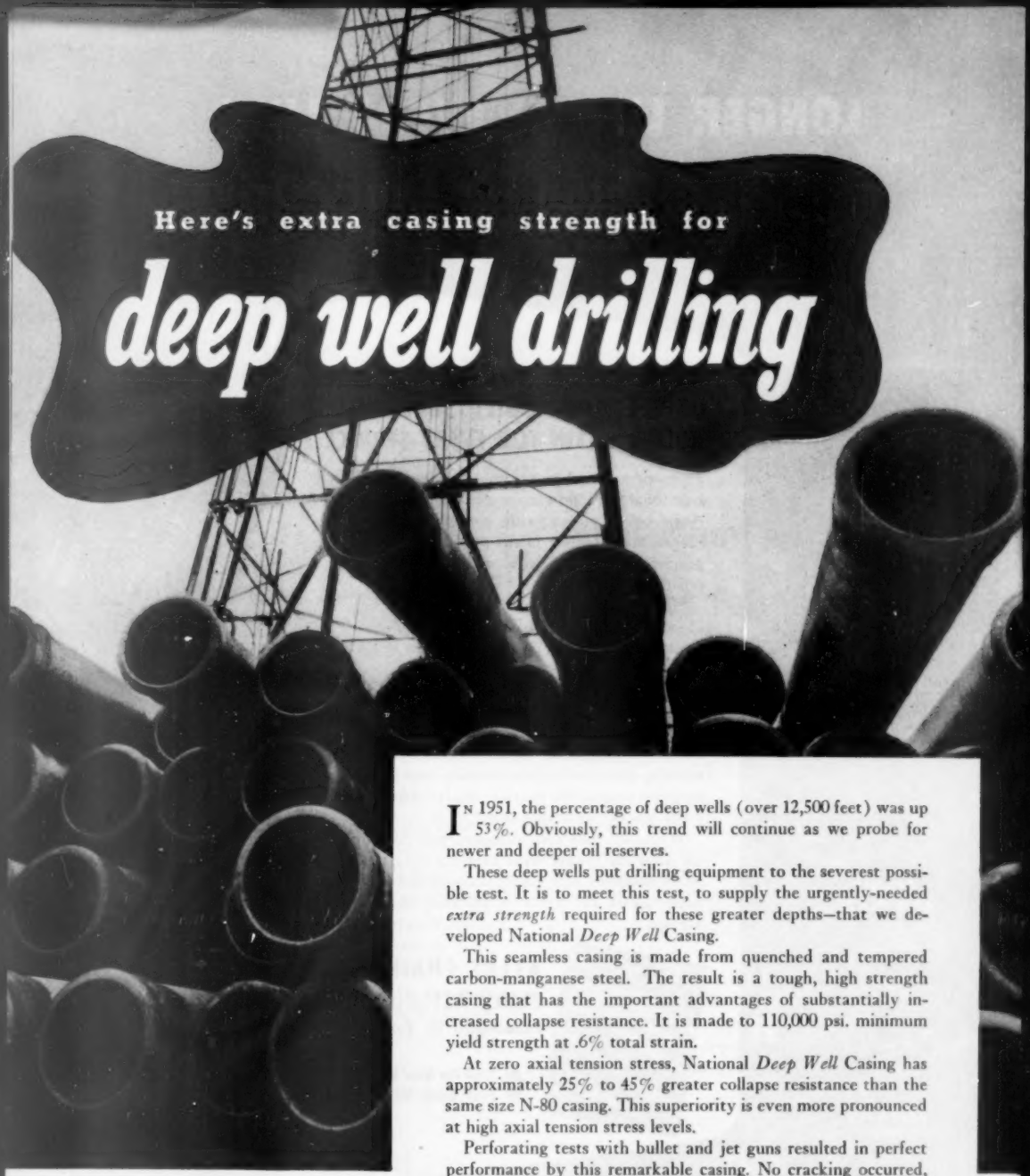

Here's extra casing strength for

deep well drilling

IN 1951, the percentage of deep wells (over 12,500 feet) was up 53%. Obviously, this trend will continue as we probe for newer and deeper oil reserves.

These deep wells put drilling equipment to the severest possible test. It is to meet this test, to supply the urgently-needed *extra strength* required for these greater depths—that we developed National *Deep Well* Casing.

This seamless casing is made from quenched and tempered carbon-manganese steel. The result is a tough, high strength casing that has the important advantages of substantially increased collapse resistance. It is made to 110,000 psi. minimum yield strength at .6% total strain.

At zero axial tension stress, National *Deep Well* Casing has approximately 25% to 45% greater collapse resistance than the same size N-80 casing. This superiority is even more pronounced at high axial tension stress levels.

Perforating tests with bullet and jet guns resulted in perfect performance by this remarkable casing. No cracking occurred, even though the shots were very close together.

Write today, and we'll send you more information on National *Deep Well* Casing.

All National Deep Well Casing is actually pierced from solid billets of high quality steel—the one manufacturing method that assures absolutely uniform wall strength.

WALLS WITHOUT WELDS

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Precision-made from specially selected steels, Atlas gives you longer life in every link. Pins and bushings are *case-hardened,* each link plate and roller *toughened*—by an exclusive Atlas heat-treating process. Built-in stamina provides extra strength to take the heaviest loads—whether uniform, uneven or severe shock.

Whatever your requirements, you can depend on Atlas for longer wear over the long pull. An Atlas engineer will gladly recommend the right roller chain for years of efficient, trouble-free service.

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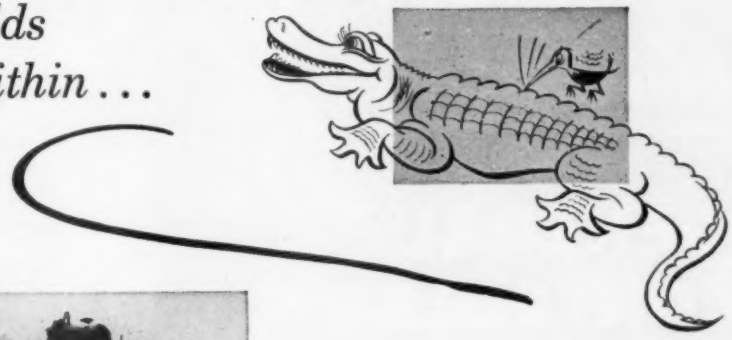

Johns-Manville Asbestos Felts shield oil and gas pipelines

Johns-Manville Asbestos Pipeline Felt—*the only type of wrapper that has survived more than 50 years of service in all types of soil*—now protects more than 100,000 miles of oil and gas pipelines!

A sturdy, inorganic product, Johns-Manville Asbestos Felt resists rot and decay, stands up in both acid and alkali soils. It has the thickness and toughness needed to shield pipeline enamels from earth load and soil stresses. And it permits the protective enamel coating to properly function against corrosion.

Johns-Manville Asbestos Felt is flexible; wraps easily without cracking. It guards enamel from impact damage both during installation of field-wrapped pipe, and during transportation and installation of mill-wrapped pipe.

There are important economic advantages, too! In addition to reducing maintenance expense, Johns-Manville Asbestos Felt adds many years of life to the pipeline. For further information and a sample of Johns-Manville Asbestos Pipeline Felt, mail the coupon below.

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PIPELINE FELT

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Please send me a copy of the sample folder on Johns-Manville Asbestos Pipeline Felt, PP-22A.

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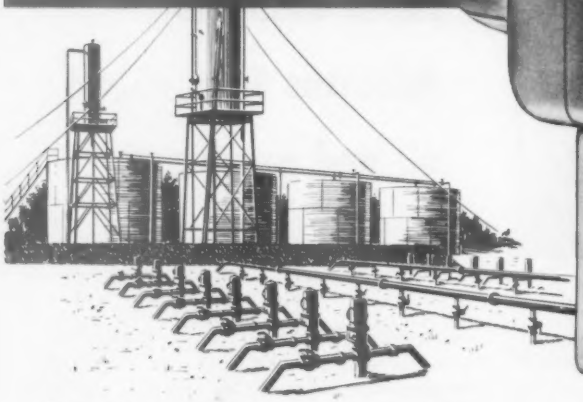

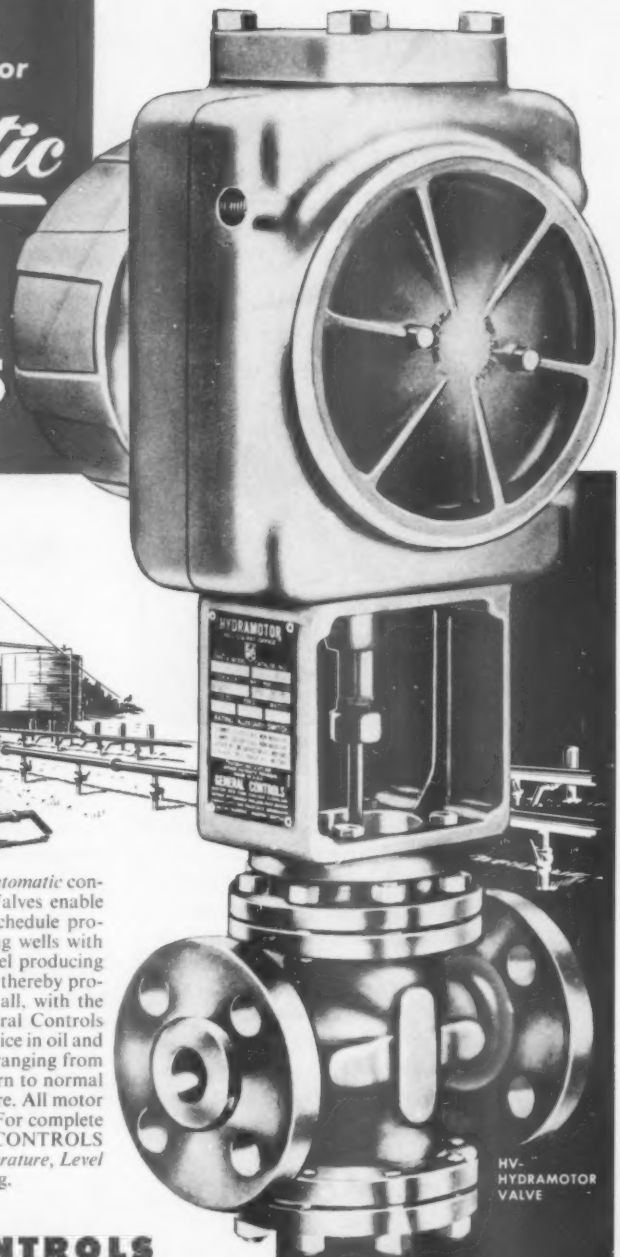

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By replacing a manual operation with *automatic* controls, General Controls Hydramotor* Valves enable tank farm operators and pumpers to schedule production periods of flowing and pumping wells with far greater accuracy and ease . . . to level producing loads . . . and to minimize maintenance, thereby prolonging the life of field equipment . . . all, with the *control* operation fully *automatic*. General Controls Hydramotor Valves are designed for service in oil and gas fields and function at temperatures ranging from −65° F. to +135° F. with positive return to normal position in 15 seconds after current failure. All motor operator parts are sealed in oil for life. For complete specifications covering the GENERAL CONTROLS broad line of *Automatic Pressure, Temperature, Level and Flow Controls*, write for new catalog.

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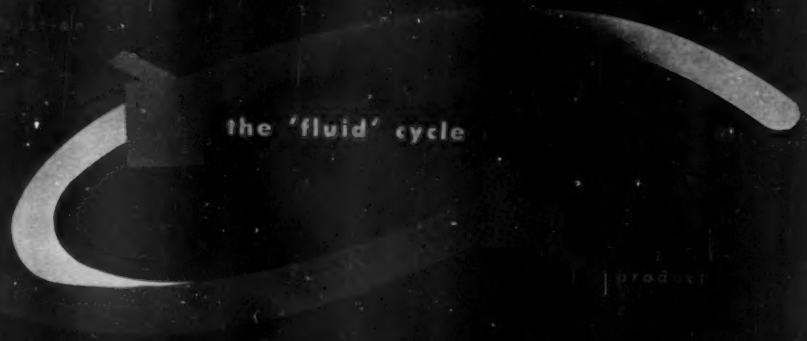
* HYDRAMOTOR (Trademark Registered) means the application of powerful hydraulic pressure generated by an electric motor-driven pump to open the valve.

catalytic reforming



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Whether in Fluid Catalytic Cracking or Fluid Catalytic Reforming, the 'fluid' system for catalyst control and heat addition represents the most flexible operating technique in the history of refining crude petroleum.

Flexibility in control of catalyst-oil ratios, in temperature and time functions, . . . in processing charge stocks of wide variation in quality, . . . plus . . continuous operation over extended periods of time, . . are invaluable operating assets that add-up to one-final result: the maximum production of high-octane gasoline per dollar invested!

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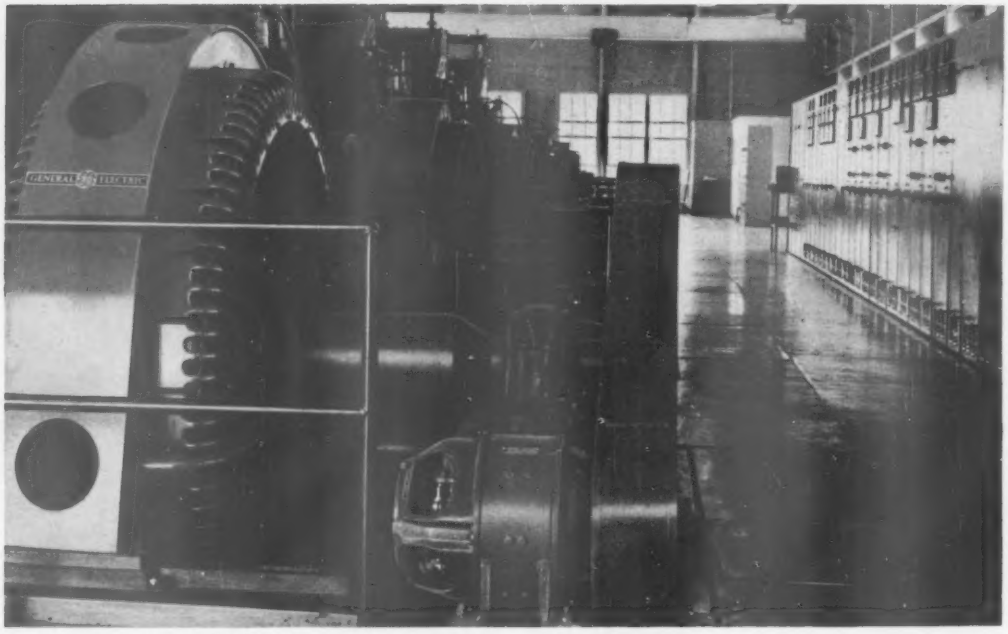
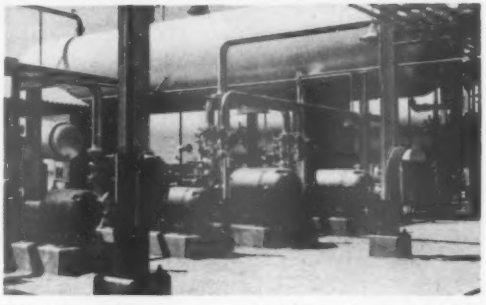


Supplying all power for Stanolind's North Cowden plant are these five G-E gas engine-driven 800-kw a-c generators, with provision made for three more when needed. Power plant also includes (right) the main G-E 4160-volt metal-clad switchgear.

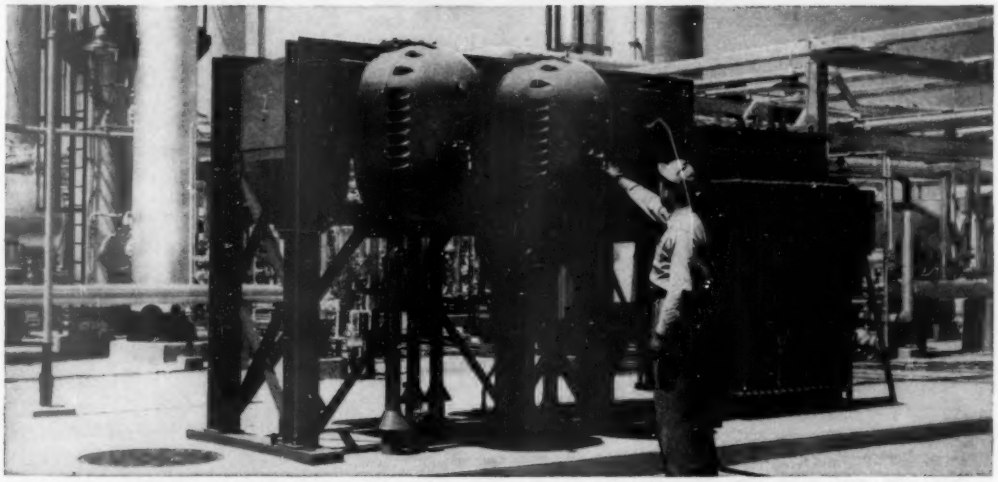


In hazardous refinery areas, use of explosion-proof motors—like these four G-E Tri-Clad* explosion-proof units at North Cowden—eliminates need for specially constructed rooms, permits locating motors for convenience and space economy.

Co-ordinated
ELECTRIC EQUIPMENT
for Gas Repressuring and Natural Gasoline Plants

Increase your workers' efficiency with General Electric's new Motor Selection and Application Course. A G-E "More Power to America" program, it gives the essentials on motors in 9 easy-to-take lessons. Bulletin GEA-4938-16 describes the course in detail. Write for it—now!

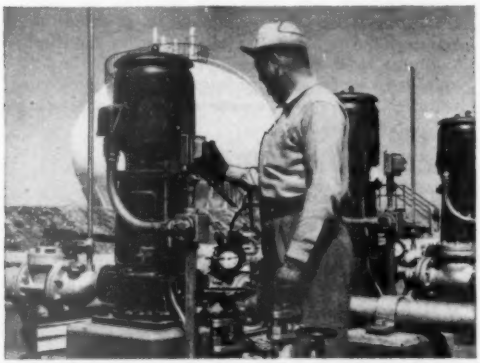
*Reg. trade-mark of General Electric Co.



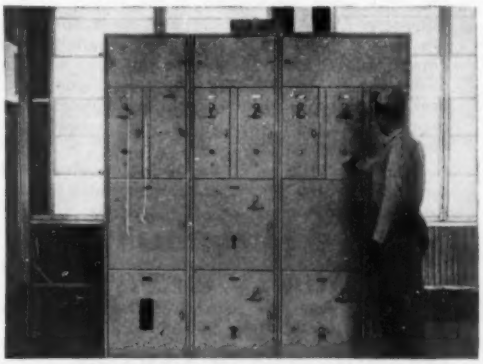
For high service continuity, eight G-E 500-kva load-center substations serving low-voltage circuits are arranged for secondary selective operation. In hazardous areas, substations are equipped with explosion-proof breakers as shown here.

New G-E equipped gas repressuring plant maintains continuous output in processing separator gas

Stanolind Oil and Gas Company's gasoline plant at North Cowden, Texas, is designed to efficiently process 100 million cubic feet per day of separator gas (now equipped for 50 million cubic feet per day) for the recovery of 300,000 gallons daily of propane, butane, and gasoline. Part of its efficiency is due to the electric apparatus supplied by General Electric, co-ordinated throughout by close engineering co-operation with Stanolind and its contractors. Ask your G-E representative how *your* refinery's electrical needs, too, can be met by G-E's skill in application engineering and project co-ordination. *General Electric Co., Schenectady 5, N. Y.* 661-35



To meet refinery conditions, G.E. builds an extremely wide line of explosion-proof equipment. These three G-E 15-hp explosion-proof vertical motors, for example, are also equipped with explosion-proof Start-Stop push buttons.



In non-hazardous areas, refineries favor grouping low-voltage motor controls for easier maintenance, as with these G-E 440-volt Cabinetrol® units at North Cowden. Compact and standardized, they save space, cut installation costs.

GENERAL ELECTRIC

PARKERSBURG HYDROMATIC

. . . the finest, most efficient drawworks brake ever built.

And here's new evidence, by the industry itself, to support this fact. Hydromatic brake sales for 1951 were the highest in the history of the Company. That means more and more operators are turning to the Parkersburg Hydromatic for the dependability, safety and economy they need in a drawworks brake. It means, too, Hydromatic Brakes, through continuous development, are giving them more and more performance and operating advantages.

Here are a few of the recent developments that are keeping Parkersburg Hydromatic Brakes the finest ever built:

46" SUPER HYDROMATIC.

Delivers 30% more braking power than our 40" double rotor hydromatic. Has the power needed to meet the braking problems of 90% of today's deep drilling operations.

OVER-RUNNING CLUTCH.

Parkersburg's recently developed over-running clutch positively and automatically engages the brake as soon as the load starts to descend. Smoother engagement eliminates shock load on brake and rig. Decreases time required for round trips about 10%. Not a single mechanical failure reported during 2 years of testing in the field. Available from Parkersburg or can be installed by your drawworks manufacturer on your new rig. Adopted as optional equipment by two leading drawworks manufacturers.

SIZES FOR EVERY RIG . . . EVERY DEPTH.

Available in 11 sizes, 15" through 60", you can get exactly the size of Hydromatic Brake you need for drilling to any depth up to 20,000 feet and more.

Write for newest Hydromatic Brake Catalog, HB-1-52. It contains complete information on the use and selection of Hydromatic Brakes, capacity charts for all sizes and other pertinent data about their installation and operation.

5203

PARKERSBURG
RIG & REEL COMPANY • Parkersburg, West Virginia

Here's another reason why the 'Specs' call for "WELDOLETS"

Extra strong WeldOlets, butt-welding, utilized to make fully reinforced branch connections in Gas Measurement Headers

LET'S COMPARE THE PLUS FEATURES OF WELDOLETS AGAINST REINFORCING RINGS OR PADS

1. The WeldOlet is a Welding Fitting rather than a hand-made reinforcement of a hand-made joint. It is both a mechanical and a pressure member.

2. The self-aligning, shaped and beveled WeldOlet is equally adaptable for shop or field fabrication. Its employment eliminates the need for additional reinforcement.
3. Production economy is realized by employment of WeldOlet construction which speeds up installation time in both shop and field fabrication. Only two welds are required to install WeldOlets.
4. The WeldOlet type of construction inherently provides sufficient reinforcement in accordance with Code requirements to meet or surpass the maximum services of whatever weight pipe is used. To facilitate determination of where it is necessary to reinforce or to use a WeldOlet, the new Bonney catalog W-3 features time-saving data on this subject.
5. Dimensional advantages of WeldOlets allow closer manifolding and cross combinations and provide improved flow conditions.

1. Precious pipe is wasted in making reinforcing rings or pads.

2. Reinforcing rings can be cumbersome to handle and clumsy to fit in both shop and field fabrication.
3. Excessive welding is necessary to complete branch reinforcing requirements according to Code provisions when rings or pads are used. Three separate welds are required. This slows down piece production time in both shop and field fabrication.
4. Lengthy calculations are necessary to determine the amount of reinforcing required when designing for ring or pad reinforcement.

The Bonney Catalog No. W-3 will show you why WeldOlet Welding Fittings offer the quickest, safest and most economical method of establishing and maintaining 100% pipe strength at branch connections in accordance with Code provisions. Write for your free copy.

CANADIAN REPRESENTATIVE
Sterling Steel Co., Ltd.
267 Davenport Road
Toronto 1, Canada

EXPORT DISTRIBUTOR
National Supply Co. Export Div.
600 Fifth Ave., New York 20, N.Y.

WELDING FITTINGS DIVISION

BONNEY FORGE & TOOL WORKS

[illegible] GREEN STREET, ALLENTOWN, PENNSYLVANIA

Here's the new

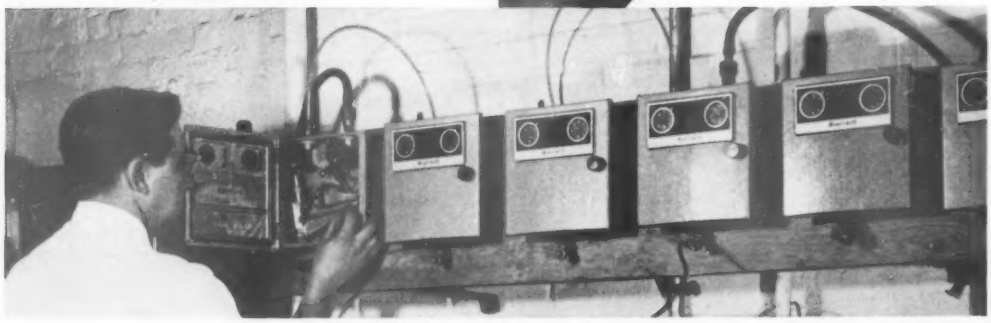
HONEYWELL PRESSURE

the heavy-duty controller

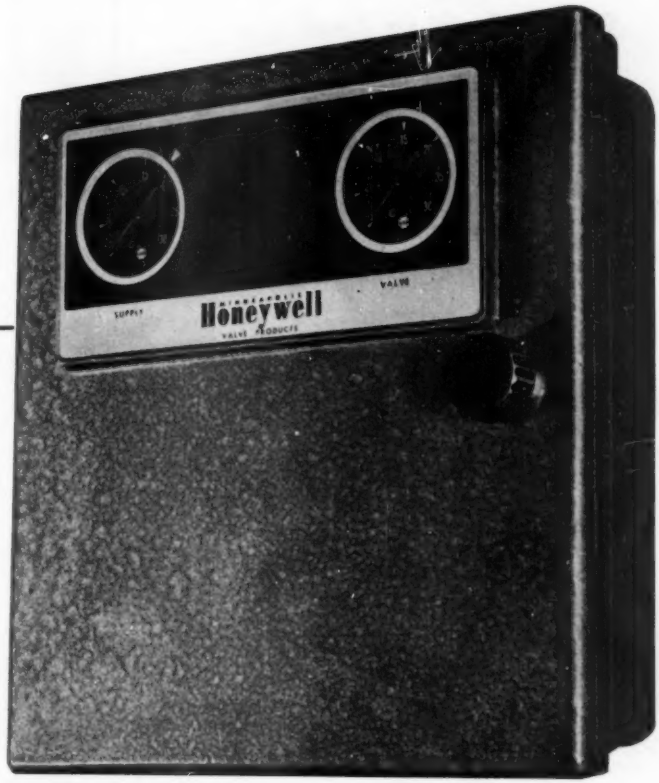
designed for accuracy at low cost

A look inside the Honeywell Pressure Pilot shows its simple design, rugged construction, and accessibility of all adjustments.

Every Pressure Pilot undergoes rigid inspection and testing before shipment.



PILOT



SPECIFICALLY designed for applications requiring accurate control where more expensive indicating or recording instruments are not warranted, the Honeywell Pressure Pilot is ideal for regulating pressure of separators, pump outlets, hydraulic systems, fluid transmission lines, cooling water lines, turbine oil, and furnace fuels.

The Pressure Pilot employs a Bourdon tube to detect line pressure changes . . . a flapper and nozzle assembly to provide a corresponding air signal pressure . . . and a pneumatic relay which amplifies the signal to position a diaphragm control valve.

Exceptional simplicity of design characterizes this new controller. Among its outstanding features are a convenient set point adjustment, unique overpressure safeguard, easy reversibility, and universal mounting.

For accurate control at low cost, for rugged construction, for dependable pressure control . . . your best buy is the Honeywell Pressure Pilot. Our local engineering representative will welcome the opportunity to give you a demonstration in your plant. Call him today . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 1906 Windrim Ave., Philadelphia 44, Pa.

MINNEAPOLIS
Honeywell
VALVE PRODUCTS
First in Controls

● *Important Reference Data*

Write for new Bulletin 16-1, "Honeywell Pressure Pilot."

The
Safest Pulling Tool
You Can Run

NO "J" SLOTS

NOT NECESSARY TO ROTATE

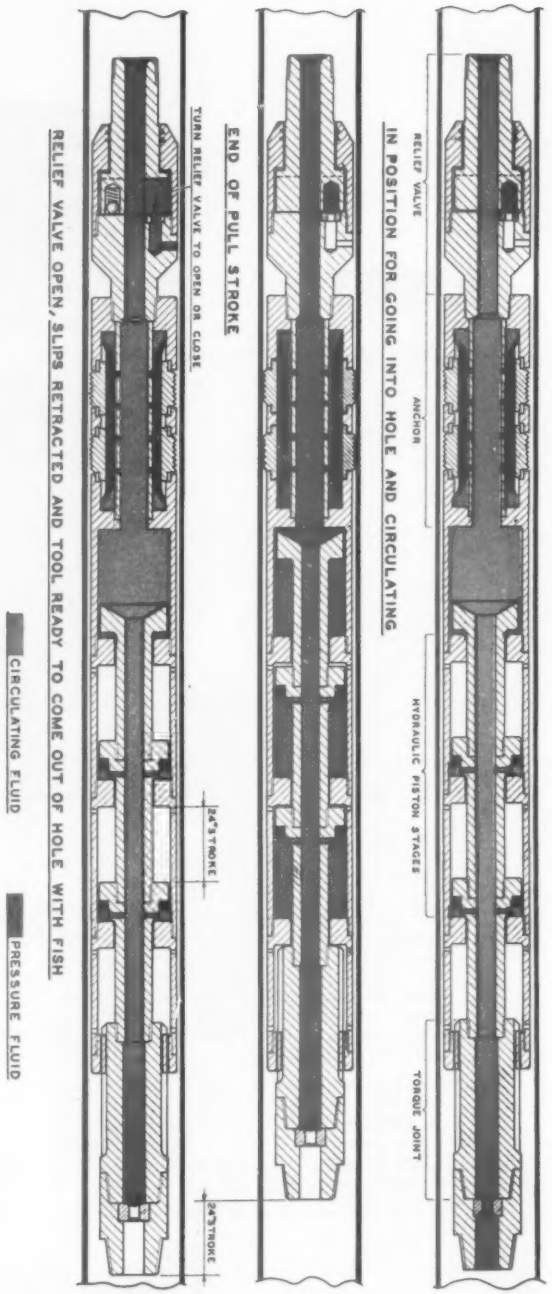
VIRTUALLY IMPOSSIBLE TO STICK IN CASING

The

WILSON
HYDRAULIC
PULLING TOOL

On your Pulling jobs remember—when you call the Fishing Tool Division of Wilson Supply Company—you get the right men and the right tools to get the job done quickly and successfully.

Fishing Tool Division


RELIEF VALVE OPEN, SLIPS RETRACTED AND TOOL READY TO COME OUT OF HOLE WITH FISH
TURN RELIEF VALVE TO OPEN OR CLOSE
CIRCULATING FLUID
PRESSURE FLUID
END OF PULL STROKE
24" STROKE
24" STROKE
IN POSITION FOR GOING INTO HOLE AND CIRCULATING
RELIEF VALVE
ANCHOR
HYDRAULIC PISTON STAGES
TORQUE JOINT

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TEXAS: Alice, Corpus Christi, Victoria, Bay City, Columbus, Barbers Hill, Liberty, Beaumont, Kilgore, Monahans.
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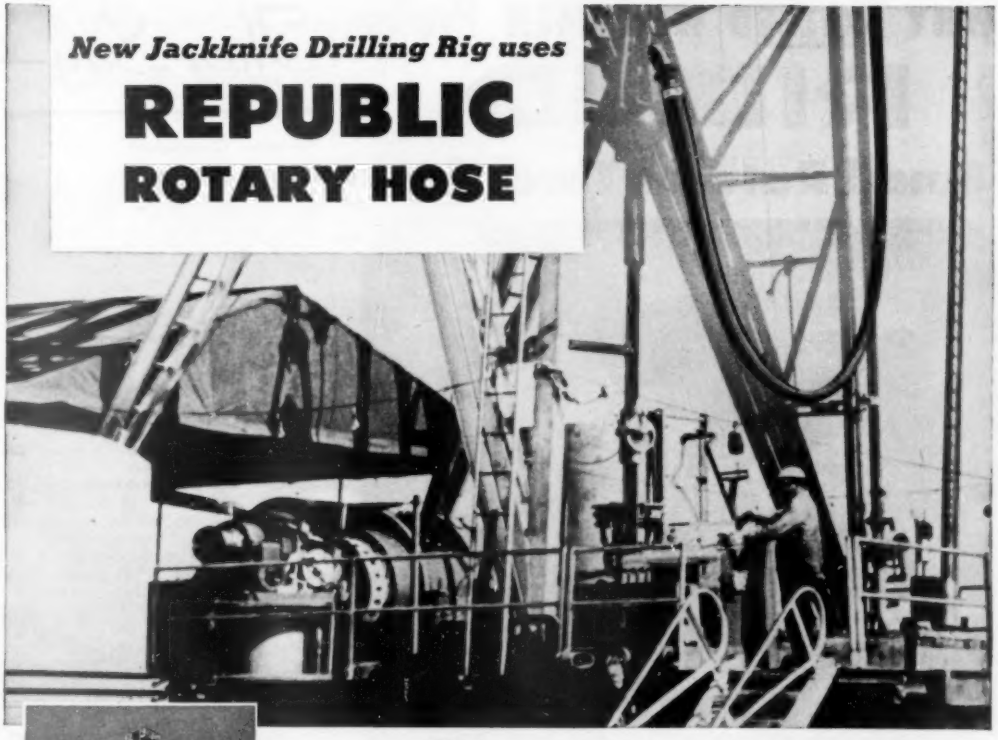
New Jackknife Drilling Rig uses

REPUBLIC ROTARY HOSE



This Wheland Company Jackknife Drilling Rig, completely outfitted with Republic Rubber Hose, is being operated by Dick Wegener, Drilling Contractor, near Duncan, Oklahoma.

for Champion performance always specify REPUBLIC

Republic's Champion Rotary Drilling Hose is the perfect choice for the new type drilling rigs now straddling the world's oil fields. These flexible carriers, made with steel reinforced oil-resistant Reprene, are designed to stand up longer under high, pulsating pressures. There are no bolts, flanges or protrusions of any kind to catch on the rigging, and the special flush-fitting, streamlined couplings, hydraulically locked into the hose carcass, will never leak or work loose. Champion Rotary Drilling Hose, a typical example of superiority in a highly specialized product, is one of many Republic Rubber Products specifically designed for oil country service. Your local Republic Distributor can show you many places where a slight difference in hose or belting can make a tremendous change in your operational economy and efficiency. Contact him today, or write direct for full facts.

INDUSTRIAL RUBBER PRODUCTS BY

REPUBLIC RUBBER DIVISION

Lee Rubber & Tire Corporation

YOUNGSTOWN, OHIO

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The Bovaird Supply Company, Tulsa, Oklahoma

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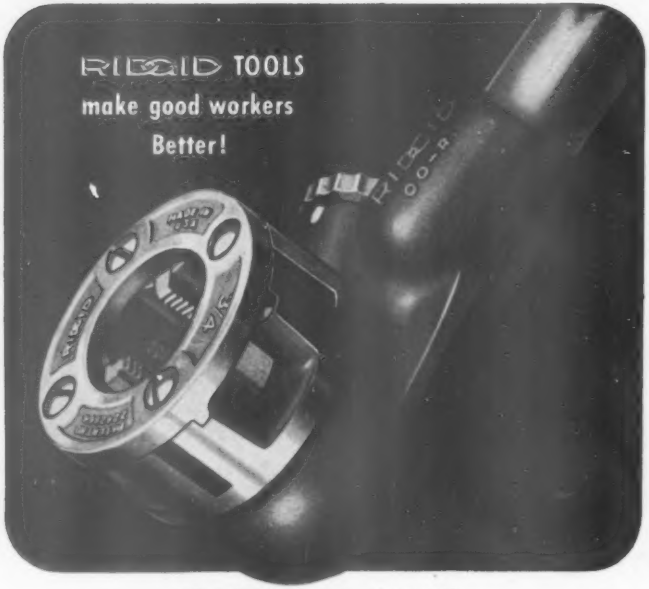
Hendrie Belting & Rubber Co., 405 Towne Ave., Los Angeles, Calif.
Pacific Coast Rubber Company, 51 Main St., San Francisco, Calif.

WHY SKILLED WORKMEN Prefer RIDGID Small Ratchet Threaders



Drop head sets to thread ⅛" to 2"

These Drop Head Dies Give You *Extra* Fast Easy Pipe Threading

★ Heads snap into ratchet ring from either side, won't fall out.

★ Precision-cut alloy dies reverse for close-to-wall threads—no special dies needed.

★ 00R & 0R, ⅛" to 1"; 111R and 11R, ⅛" to 1¼"; 12R, ⅛" to 2". Conduit dies available.

★ Buy at your Supply House.

THE RIDGE TOOL COMPANY • ELYRIA, OHIO

★★★ RIDGID Work-Saver Pipe Tools ★★★

They Say—

Newness Questioned

Sirs:

An article in your issue of December 20, 1951, entitled "Starving Oil Fires" describes a "new" method of controlling oil tank fires by agitation, said to have been developed by J. L. Risinger, of Socony-Vacuum Oil Company, Inc.

As the author appears to be unacquainted with the work on the same subject already done in Great Britain, attention is drawn to the publication of J. H. Burgoyne and L. L. Katan in the Journal of the Institute of Petroleum 1947, vol. 33, p. 158 (March), in which the principles and application of the technique of agitation are examined in some detail. The experiments described were carried out on behalf of the Ministry of Home Security and the Department of Scientific and Industrial Research, at Imperial College, and at Llandarcy installation of National Oil Refineries, Ltd., during the years 1943 to 1946.

The desirability of extending the work of Burgoyne and Katan with experiments on the large scale has since been stressed (see for example Oil 1950, vol. 1, No. 9, p. 12) and the American tests are to be welcomed as a move in this direction. At the present stage, however, the technique of agitation can no longer be described as 'new.'

J. H. Burgoyne
Imperial College of
Science and Technology
London.

More Control Means Less

"It is the firm opinion of your management that the growing tendency for the Government to control wages, prices, profits, and countless other phases of business will inevitably result in less real dividends for you, lower real earnings for our employes, greater costs of goods for the consumer and most serious of all, the loss of personal liberty for us all.

"What has happened recently in the steel industry can equally as well happen to our and other industries. Some may like Government by dictatorship if the dictator is on their side, but dictators change and then with a government by law no longer available to protect the weak from the strong, the just from the unjust, those who formerly applauded are likely to find themselves slaves.

"This could easily be the fate of those who now think they would benefit from further increasing the power of already uncontrolled big labor, not only over the local unions

Remember – the trade marks "tt" and "TUBE-TURN" are applicable only to products of TUBE TURNS, INC.

Engineered for efficient flow

EFFICIENT FLOW in piping systems is worth striving for . . . it saves kilowatt-hours and avoids over-investment in equipment. That's why, on this TUBE-TURN Welding Elbow, so much engineering attention is devoted to true circularity, smooth inner walls, and exact radius. They all contribute to minimum flow resistance and reduced pressure loss.

When you specify TUBE-TURN Welding Fittings and Flanges you are specifying careful engineering. Get in touch with your nearby TUBE TURNS' Distributor. You'll find one in every principal city.

Write Dept. J-5 for free booklet "Pipe and Fitting Materials" which gives specifications, properties and welding procedures for various materials.

Be sure you see the double "tt"

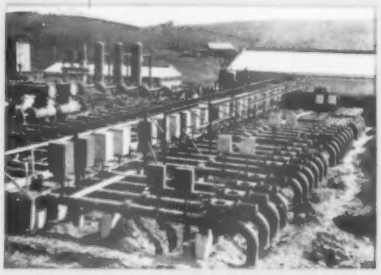
TUBE TURNS, INC. LOUISVILLE 1, KENTUCKY

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Chicago • Houston • Tulsa • San Francisco • Los Angeles
TUBE TURNS OF CANADA LIMITED, CHATHAM, ONTARIO . . . A wholly owned subsidiary of TUBE TURNS, INC.

New station for underground storage being built in record time

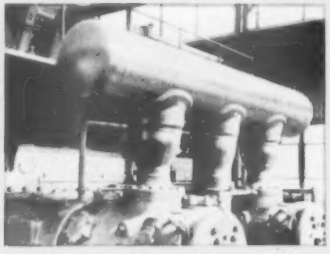
Top-flight engineering, fabrication and construction are teamed up near Delmont, Pa., to speed the building of the huge Oakford Station of New York State Natural Gas Corporation. Construction of this station for storage of natural gas in 378 wells of the area started a year ago and forged right ahead during the winter months. The station now is in partial operation. Maximum pumping pressure will be 1200 pounds per square inch. All-welded piping, with TUBE-TURN Welding Fittings and Flanges, will contribute to the efficiency and low maintenance of this modern plant. Plans are for doubling of present capacity of 400 million cu. ft. per day.

General Contractors: Ford, Bacon and Davis, Inc.
Piping Fabricators: Dravo Construction Company



Foreground: gas measuring station. Background: gas scrubbers and separators. Includes wide assortment of various types and sizes of TUBE-TURN Welding Fittings and Flanges.

Majority of welding was done in the shop, however, much was done in the field . . . such as this tie-in to a 6-inch line in measuring station, made with a TUBE-TURN 90° Welding Elbow.

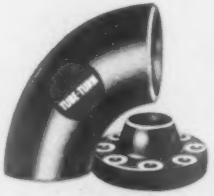


Closeup of one of station's compressors. Shows header fabricated from pipe and TUBE-TURN Welding Reducers, Saddles and Caps.

Expansion loops in discharge lines from compressor station. Lines are 24-inch, 20-inch and 14-inch with TUBE-TURN 90° Welding Elbows.

TUBE TURNS, INC., Dept. J-5
224 East Broadway, Louisville 1, Kentucky

Your Name .....
Position .....
Company .....
Nature of Business .....
Address .....
City ..... *State* .....



DISTRICT OFFICES

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"tt" and "TUBE-TURN" Reg. U. S. Pat. Off.

TUBE TURNS, INC.

LOUISVILLE 1, KENTUCKY

and the workers who do not want to become organized but also over the Government, itself."

George V. Holton, chairman of the board, addressing annual stockholders' meeting of Socony-Vacuum Oil Co., Inc.

Profits to Be Lower

"During recent years the efficiency of the new facilities installed, together with greatly increased sales, both in units and dollars, have enabled the company to offset the sharp and continuing increases which have occurred in all of its costs and expenses of doing business.

"From this point on it will be increasingly difficult, and perhaps not possible, to offset fully these increases in all costs, including those of wages, salaries, purchased materials and services. For these reasons I would say that it now appears probable that net earnings for 1952 will decline somewhat from the high level of 1951."

C. T. Foster, president of Standard Oil Co. (Ohio), addressing annual stockholders' meeting, Cleveland.

CALENDAR OF EVENTS

MAY

19-20	American Petroleum Institute, Division of Marketing, midyear meeting, Sheraton-Plaza Hotel, Boston.
19-20	American Association of Oilwell Drilling Contractors, seventh annual safety clinic, Adolphus Hotel, Dallas.
21-23	Gas Appliance Manufacturers Association, annual meeting, Broadmoor Hotel, Colorado Springs, Colo.
26-28	American Gas Association, production and chemical conference, Hotel New Yorker, New York.
27-28	American Petroleum Institute lubrication committee, Mayo Hotel, Tulsa.
27-29	Southwestern Gas Measurement Short Course, University of Oklahoma, Norman.
28-30	Seventh annual short course in gas technology, sponsored by the Southern Gas Association, Texas College of Arts and Industries, Kingsville, Tex.
29-30	Society of Exploration Geophysicists, Gulf Coast regional meeting, Rice Hotel, Houston.

JUNE

1- 6	Society of Automotive Engineers, summer meeting, Ambassador and Ritz-Carlton hotels, Atlantic City, N. J.
2- 4	Seventh annual short course on process instrumentation, A. & M. College of Texas, College Station
5- 6	Natural Gas and Petroleum Association of Canada, Niagara Falls, Ontario.

Preferred power on cement surfacing and concrete working machines — the world's most widely used single-cylinder gasoline engine on tools, machines, appliances used by the construction industry, railroads, oil fields, other industries, and on farms and farm homes.

You know you have the *right* power when the power is Briggs & Stratton — the accepted leader in single cylinder, 4-cycle, air-cooled gasoline engines. Briggs & Stratton Corporation, Milwaukee 1, Wisconsin, U.S.A.

In the automotive field Briggs & Stratton is the recognized leader and world's largest producer of locks, keys and related equipment.

Snap-on* Tools
cut "Down-Time," too

You'll often save enough *in labor-time alone,* to pay for the *right* Snap-on Tool to reach hard-to-get-at spots such as these generator coupling flange nuts. The more important savings in "down-time" are so much "velvet."

On this job, as you can see, there's no room for the head of a ratchet wrench, nor is there either jaw-room or handle-clearance for an open-end wrench. But a Snap-on L-53 Sliding Bar does the trick, with a safe, sure, snug fit and an easy half-turn-at-a-time action, without once disturbing the grip of the socket.

Ten to one, there are maintenance or overhaul jobs just as time-wasting, potentially, as this in your plant. And the odds are still better that there are many Snap-on Tools that would swiftly pay for themselves. Here Snap-on's nation-wide tool service can be mighty helpful!

Write for industrial catalog and 104-page general catalog!

SNAP-ON TOOLS CORPORATION
8098-E 28th Avenue
Kenosha, Wisconsin

*Snap-on is the trademark of Snap-on Tools Corporation.

5- 6	Pennsylvania Grade Crude Oil Association, annual meeting, Hotel William Penn, Pittsburgh.
5- 7	National Oil Scouts and Landmen's Association, annual convention, Hilton Hotel, Albuquerque, N. M.
7	California Natural Gasoline Association, annual June Frolic, Rio Hondo Country Club, Downey, Calif.
8-12	Canadian Gas Association, Chateau Frontenac, Quebec.
9-14	American Petroleum Institute, midyear standardization meeting, Brown Palace Hotel, Denver.
12-13	Western Petroleum Refiners Association, regional technical and industrial-relations meeting, Broadview Hotel, Wichita.
13-14	Rocky Mountain Oil and Gas Association, midyear meeting, Rainbow Hotel, Great Falls, Mont.
16-22	International Gas Conference, Brussels, Belgium.
19-20	Kentucky Oil and Gas Association, annual meeting, Hotel Lafayette and Phoenix Hotel, Lexington, Ky.
22-25	Petroleum Equipment Suppliers Association, Mark Hopkins Hotel, San Francisco.
23-24	Michigan Gas Association, annual meeting, Grand Hotel, Mackinac Island, Mich.
23-27	American Society for Testing Materials, annual meeting, Hotel Statler, New York.
23-27	American Institute of Electrical Engineers, summer general meeting, Nicollet Hotel, Minneapolis.

AUG.

1- 3	Wyoming Geological Association, field trip, Big Horn basin.
11-13	Society of Automotive Engineers, national West Coast meeting, Fairmont Hotel, San Francisco.
19-22	American Institute of Electrical Engineers, Pacific general meeting Westward Ho Hotel, Phoenix, Ariz.
25-27	Twelfth Annual Appalachian Gas Measurement Short Course, West Virginia University, Morgantown, W. Va.

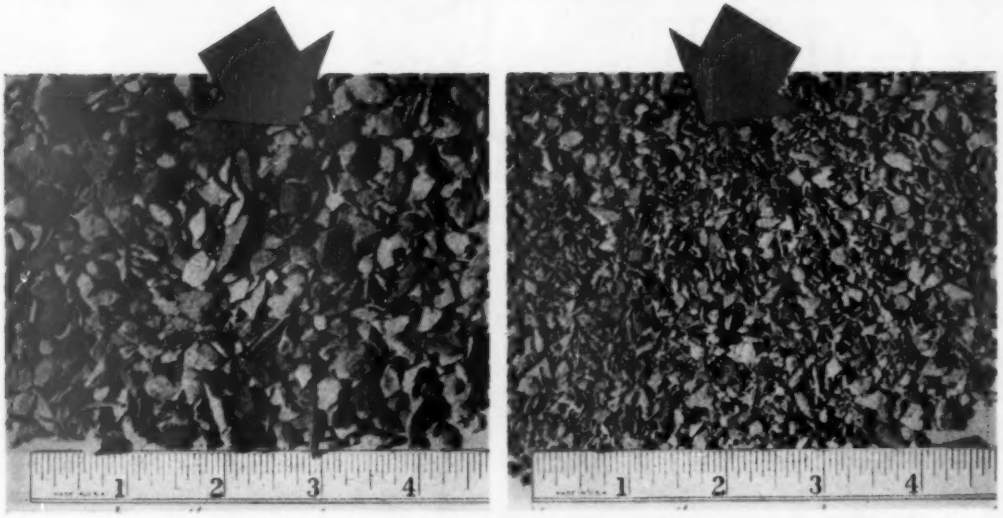
SEPT.

3- 5	Pacific Coast Gas Association, Ambassador Hotel, Los Angeles.
8-12	Instrument Society of America, seventh national instrument conference and exhibit, Cleveland.
10-12	National Petroleum Association, fiftieth annual meeting, Hotel Traymore, Atlantic City, N. J.
11-13	American Institute of Chemical Engineers, regional meeting, Palmer House, Chicago.
25-26	Western Petroleum Refiners Association, regional meeting, Hotel Henning, Casper, Wyo.
28-30	American Association of Oilwell Drilling Contractors, annual meeting, Skirvin Hotel, Oklahoma City.

OCT.

1-3	National Association of Corrosion Engineers, South Central Region, technical program and committee meetings, Jung Hotel, New Orleans.
1- 3	American Institute of Mining and Metallurgical Engineers, Mid-Continent fall meeting, petroleum branch, Rich Hotel, Houston.
2- 3	Petroleum Electric Power Association, twenty-third annual meeting, Mayo Hotel, Tulsa.
6	Independent Natural Gas Association of America, annual meeting, Fontenelle Hotel, Omaha, Neb

Which bit drilled more hole ... faster? TWIN-BLAST or conventional?



Just a glance at these cuttings will tell that the **REED** Twin-Blast Bit drilled much faster. Here's why:

Cuttings taken with a conventional bit (right) are small, indicating that considerable recutting had taken place.

Cuttings taken with a Twin-Blast Bit (left) are large, indicating a minimum of recutting. This means more "bite" per revolution, and faster drilling — more footage per bit, and fewer round trips.

Hundreds of bit records show what these cuttings indicate — **REED** *Twin-Blast Bits reduce drilling costs.*

REED *TWIN-BLAST* ROCK BITS

drill more hole... faster

REED ROLLER BIT COMPANY

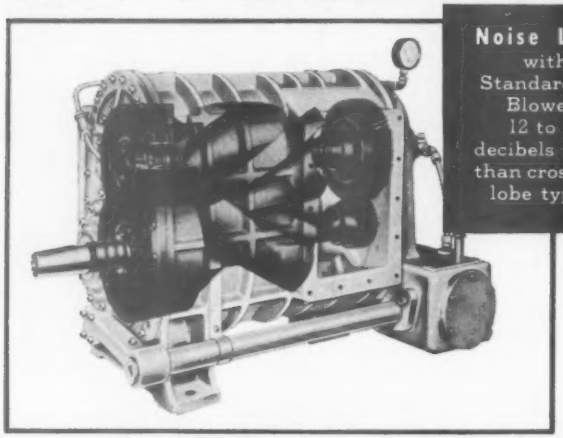
HOUSTON 1, TEXAS

NEW YORK LONDON BUENOS AIRES

2409

Gulf Coast, Mid-Continent, Rocky Mountain and Canadian Distributor for Martin-Decker Products

MUST BLOWERS BE LOUD OR QUIET Like a STANDARDAIRE



Noise Level with Standardaire Blowers 12 to 18 decibels lower than crossflow lobe types.

STANDARDAIRE QUIETNESS MEANS LESS WEAR--MORE AIR

IMPARTIAL tests have proved conclusively that Standardaire Blowers with their smooth, gradual delivery action minimize shock and sound pulsations . . . a distinct contribution to quiet operation. Then too, the noise level does not noticeably increase with higher pressures. With the Standardaire principle you squeeze the air gently instead of slapping it . . . a feature that eliminates shock load on the internal parts of the blower. This, of course, means less wear and prolongs service life, even under severe operating conditions.

Write .....

Read Standard Corporation, Dept. F-34, 370 Lexington Ave., New York 17, N. Y.

AXIAL FLOW STANDARDAIRE BLOWER

BLOWER-STOKER DIVISION

READ STANDARD CORPORATION

NEW YORK • CHICAGO • ERIE • YORK • LOS ANGELES

9-10	California Natural Gasoline Association, twenty-seventh annual fall meeting, Ambassador Hotel, Los Angeles.
13-15	Texas Mid-Continent Oil and Gas Association, thirty-third annual meeting, Hotel Texas, Fort Worth.
13-17	American Institute of Electrical Engineers, fall meeting, New Orleans.
16-19	Permian Basin Oil Show, Odessa, Tex.
19	Natural Gasoline Association of America, southern regional meeting, Blackstone Hotel, Tyler, Tex.
20-21	Independent Petroleum Association of America, annual meeting, Mayo Hotel, Tulsa.
22-24	Society of Automotive Engineers, national transportation meeting, Hotel William Penn, Pittsburgh, Pa.
23-24	American Institute of Mining and Metallurgical Engineers, West Coast fall meeting, petroleum branch, Statler Hotel, Los Angeles.
27-31	American Gas Association, annual convention Atlantic City, N. J.
30-Nov. 1	Rocky Mountain Oil and Gas Association, annual meeting, Cosmopolitan Hotel, Denver.

NOV.

3- 4	Society of Automotive Engineers, national diesel engine meeting, Chase Hotel, (tentative), St. Louis, Mo.
6- 7	Society of Automotive Engineers, national fuels and lubricants meeting, Mayo Hotel, Tulsa.
6- 8	Gulf Coast Association of Geological Societies, annual fall meeting, Hotel Driscoll, Corpus Christi, Texas.
8-13	Oil Industry Information Committee, Conrad Hilton Hotel, Chicago.
10-13	American Petroleum Institute, thirty-second annual meeting, Conrad Hilton Hotel and Palmer House, Chicago.
13-14	Society of Exploration Geophysicists, midwestern meeting, Texas Hotel, Fort Worth.
20-22	Instrument Maintenance Short Course, jointly sponsored by Southern California Meter Association and Los Angeles Harbor Junior College.
30-Dec. 5	American Society of Mechanical Engineers, Statler Hotel, New York City.

DEC.

7	Natural Gasoline Association of America, Panhandle-Plains regional meeting, Herring Hotel, Amarillo, Tex.
7-10	American Institute of Chemical Engineers, annual meeting, Hotel Cleveland (Hqs.) and Carter Hotel, Cleveland.

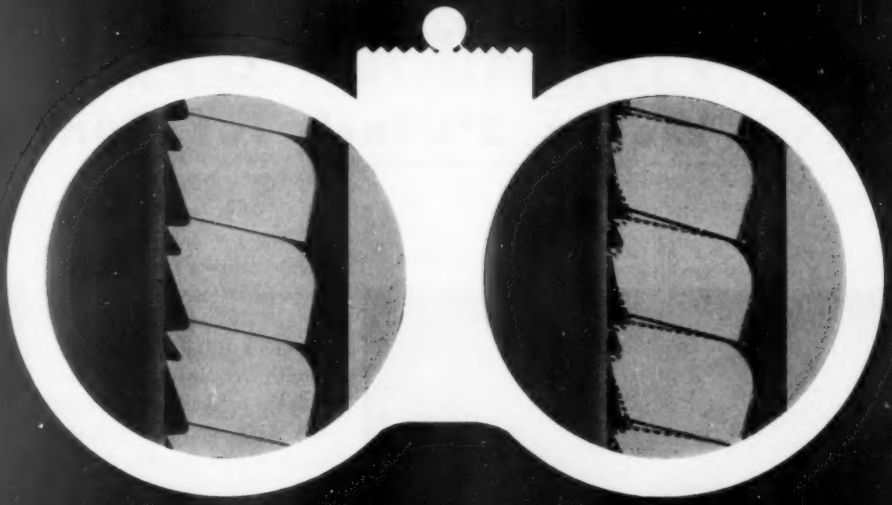
NOMADS

Tulsa Nomads, third Friday of each month. After Five Room, Tulsa Hotel.

Dallas-Fort Worth Nomads, first Monday of each month, Greater Dallas Club.

Houston Nomads, second Monday of each month, Ye Ole College Inn, Houston.

Los Angeles Nomads, second Wednesday of each month, Jonathan Club.



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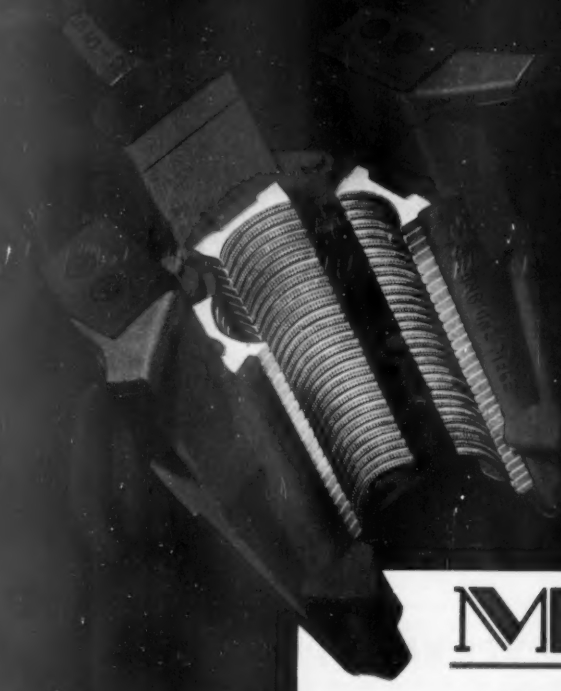

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TULSA, OKLAHOMA

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JOURNALLY Speaking

East is East

COMES now the National Geographic Society and says that oil men and others are all wrong in their concept of the Middle East. Says that what the oil industry calls Middle East is really Near East and that the real Middle East is what a lot of people call Far East and that the Far East is so far east that it's west to Californians. Seems that somehow or other all the easts got moved west, and the N.G.S. blames it, like a lot of other things, on the war.

National Geographic, backing up its assertions by our own State Department, claims that the only really and truly Middle East is India, Pakistan, Afghanistan, and Ceylon. Everything east of Middle East is Far East—China, Burma, Singapore, et al. Everything west of Middle East is Near East, and that takes in Iran, the Persian Gulf, Saudi Arabia, Egypt, Turkey, and everything else in that vicinity.

So what about the "Middle East oil" that our independent producers fear may become such a threat? There ain't no such animal, according to National Geographic. The independents have been barking up the wrong tree.

Time was, back around the time of World War I, when Americans thought of the Near East as taking in everything from the eastern end of the Mediterranean to at least as far east as the Persian Gulf and the Tigris and Euphrates rivers, if not clear to the edge of India. But in those days Americans thought of Near East chiefly in terms of foreign missions and relief work, rather than oil. The British, apparently, were responsible for shifting the east west. They were accustomed to thinking of Greece and North Africa as Near East because they were near to England, so Iranian oil seemed like Middle East to them.

Then during World War II, American writers operating with British commands in that general region picked up the British habit, and war communiques and news dispatches from as far west as Tripoli and Benghasi carried Middle East date lines. In that way the expanding Middle East pushed the poor old Near East right out into the Mediterranean Sea.

Now the National Geographic Society is trying to put the three Easts back where they belong. But it will have a tough time trying to get oil men to change their way of speaking. A bunch of men who still refer to a sumptuous trailer as a doghouse and an intricate system of pressure valves as a christmas tree aren't apt to change their notion of east, National Geographic Society or no National Geographic Society.

Sporting Event

SINCE this department serves as the sports page, society page, and general repository of incidental intelligence which doesn't fit precisely into any other section of the Big Yellow Book, we take pleasure in disseminating the word that Premier Oil Refining Co. will have its annual golf tournament August 22-24.

The newsworthiness of this announcement is that Premier's golf match is not confined to its employes but is open to anybody engaged in or connected with the oil industry. It will be held on the company's private links near its refinery at Longview, Tex., advertised as one of the sportiest in these parts. Proceeds from the entry fees go to local charity. If you don't like golf, go anyway, because there's also a big barbecue. Last year there were 122 people in the tournament and 1,500 at the barbecue, which may be a fair measure of the relative popularity of these two outdoor sports in East Texas.

No Quake

A NOTE from our old friend, Uintah Liz of Vernal, Utah, who still thinks we ought to spell Uinta basin with an "h," says that what we Oklahomans thought was an earthquake was Thomas Jefferson and Andrew Jackson turning over in their graves when Harry Truman seized the steel mills.

—*Henry D. Ralph*

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THE OIL AND GAS
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- Analysis of accidents sustained by members of well-servicing crews.
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This strike "settlement" may be very unsettling

IT looks at the moment as though the Wage Stabilization Board has "settled" the oil strike by a nation-wide increase of 15 cents an hour in base wages.

Actually nothing is settled, even though there may be quiet on the labor front in the petroleum industry. A flat increase, dictated by arbitrary government fiat, disregarding local conditions, satisfies neither workers nor employers. It destroys collective bargaining and disrupts the delicate economic adjustments among individual elements of the industry.

THE whole procedure demonstrates the folly and unreliability of government control of a planned economy. At the outset the administration laid down so-called stabilization rules to curb increases in wages and prices. Under this formula no oil worker was to get an increase of more than 10 cents an hour. This was a challenge to the unions, so they set out to break the formula.

Now, under pressure, the WSB has changed its mind and its formula and will approve 15 cents. The chief economic stabilizer says this "will not be unstabilizing to the industry or to the national economy."

In making this statement he was looking—if he was looking at any data—at the over-all earnings position of some of the larger integrated oil companies and guessing that they can absorb higher wage costs.

THIS might turn out to be a good guess or it might not. It might be true as to some companies but not as to others. This kind of across-the-industry dictate is a poor substitute for plant-by-plant bargaining which can consider local living and working conditions and the individual employer's ability to pay. It could be ruinous.

The cost of producing, transporting, and refining oil varies widely from area to area and from operator to operator. Many refineries now are operating on a very small margin of profit due to their size, location, or the nature of their equipment. Many of these are located in communities where the cost of living and prevailing wage rates are relatively low.

The wage pattern in the oil industry, set through plant-by-plant bargaining, has traditionally recognized these differences in economic conditions. There has never been a flat, standard wage for a given occupation throughout the industry, and there is no need for one. On the contrary, such uniformity would be very "unstabilizing," regardless of what Washington bureaucrats say.

The WSB's flat 15-cent increase will not wipe out all local differentials, but it is a step in that direction. And if all refiners are forced to give the maximum increase, some of them are going to be in financial difficulties.

THIS WEEK

SIGN OF THE TIMES was this one on a Sinclair station in Chicago, only a few miles from the company's strike-bound 90,000-bbl. refinery. The spelling left something to be desired, but the meaning was perfectly plain to all motorists low on gasoline.

STRIKE.—WSB fixes maximum wage increase at 15 cents and unions accept with reluctance. . . . Pattern could mean refinery output would be back to normal within a week. . . . Action came just after Oscar Chapman authorized appointment of local committees to deal with spot shortages of products. . . . Even with 15-cent rule, settlement of strike could take time, since all negotiations must be carried out on local basis. . . .

TRENDS.—It is about 40 weeks until the end of the period of possible fuel shortage next winter. . . . For each week that refineries are closed by strike, average refinery runs will have to be increased by one-fortieth of the daily average loss in runs during the strike period. . . . If the effects of the strike continue for 3 weeks, it is estimated that average runs for the next 40 weeks will have to be increased 165,000 bbl. daily over previous estimates in order to meet next winter's fuel demands. . . .

ACTIVITY.—Data on crude production for week ended May 10 are incomplete. . . . ¶Total well completions for the week decreased 68 wells to 838. . . . Wildcat completions dropped 39 wells to 169. . . . ¶Rotary rigs operating in United States on May 12 totaled 2,847, up 32 from previous week and 408 from same week last year. . . .

STORAGE.—Capacity of underground caverns for storing natural gas increased 33 per cent last year, now represents an investment of $170,000,000, Equitable's Goodman tells A.G.A. . . . ¶NPC releases report saying underground storage is practical in many sections of the country and is less expensive in terms of steel and manpower. . . . Committee recommends permanent state committees to make studies of local sites which might be used. . . .

INTERNATIONAL.—Fifth wildcat in Neutral Zone watched as it approaches critical depth. . . . This test is well away from four earlier wells, all of which were dry. . . . ¶Crude and products system connecting Santos with Sao Paulo, Brazil, scheduled to go into operation this month. . . . Burmah Oil delegation arrives in Karachi to study proposed plans for construction of Pakistan refinery. . . .

COURTS. — Supreme Court declines to review Oklahoma's compulsory unitization law, saying there is no substantial federal question involved. . . . Decision upholds nation's first law compelling participation in a unit operation under certain conditions. . . . ¶Trial begins in Texas in pipe-line companies' suit to recover gas-gathering taxes paid since last September. . . . Arguments scheduled for June 30. . . . Case involves legality of state's 0.45-cent per M.c.f. levy against transmission companies. . . .

PIPE LINES. — Transcontinental Gas Pipe Line Corp. lays 6,600 ft. of 24-in. pipe across the bottom of the New York Harbor without interrupting ship traffic. . . . Pontoons, provided partial buoyancy, were used as a unique method known as submerged flotation to install the final section of the company's 1,840-mile gas trunk line from the Southwest. . . . ¶United Gas Pipe Line plans new submarine gas line to provide an outlet for gas reserves in the Ship Shoal area off the Louisiana coast. . . . Recoverable reserves in the area, belonging to Phillips, Stanolind, and Kerr-McGee, are estimated to be about 300 billion cubic feet. . . . ¶Cities Service Gas gets the go-ahead from the Federal Power Commission to increase capacity of its system north of Welda, Kans. . . .

DRILLING.—Shell solves costly problem in California's South Mountain field with switch from mud to compressed air. . . . Air drilling cuts cost of surface holes in half compared with cable-tool drilling, tried after conventional drilling proved impractical. . . . ¶Mud survey in California shows majority of operators prefer phosphate and phosphate emulsion fluids, with red muds and lime muds gaining in popularity. . . . ¶Shell announces it will drill 200 wells in California and 25 in Rockies this year, a big jump over 1951. . . .

REFINING.—Refiners told to check up on their own operations in studying air pollution. . . . New theory, A.P.I. speaker says, says smog is caused by reaction products of primary olefins and an oxident, presumably ozone. . . . Whether proved or not, he says, theory is likely to bring investigations of refining industry. . . .

15-Cent Limit Fixed

Settlement pattern may mean all plants will be back on stream within a week, but local talks could cause delay

A PATTERN for quick settlement of the oil strike was laid down late Wednesday when Economic Stabilizer Roger L. Putnam announced that the Wage Stabilization Board would approve wage increases up to 15 cents an hour.

Officials of the striking unions accepted the decision reluctantly and urged companies and local unions to negotiate new contracts on this basis.

Since a good many oil companies already had made offers of about 15 cents it appeared that settlements would be made quickly and that most of the shutdown refineries and other installations would be operating again within a few days.

However, all contracts had to be negotiated on a plant-by-plant basis and in many cases there were local issues which threatened to delay final agreement.

Some of the refining companies, particularly those with smaller plants and those not located advantageously from an economic standpoint, were very reluctant to increase wages as much as 15 cents an hour because this might wipe out their margin of operating profit. Attempts to settle at a lower figure could delay resumption of work at some of these installations. There was also the possibility that union leaders at some plants would inject new issues when negotiations resume.

What remains . . . In view of these uncertainties, many in the industry felt that it might be at least a week before all shutdown plants are back in operation. A separate wage contract must be negotiated at each plant and in many cases, this must be approved by the head office of the company and the central committee of the union, and after that it must be individually approved by the WSB.

It takes approximately 48 hours to get a refinery back on stream after the crew returns to work. There was a possibility that many strikers would return to work pending formal completion and approval of new contract, once the general pattern of settlement had been agreed to. Removal of pickets from storage terminals would free supplies for distribution to filling stations and consumers prior to resumption of refining operations.

At the week's end the prospect of early settlement brought relief to oil operators and consumers alike. The strike which started April 30 had closed more than 50 refineries representing more than one-third of the nation's capacity to produce petroleum products, and picketing had interfered with distribution of much of the stocks on hand in bulk terminals.

Filling stations were running dry in some areas. Motorists generally and fleet operators in particular were faced with a paralyzing gasoline shortage if the strike continued. An end to the strike would free stocks for distribution to customers even though it will take some time to get all refineries back to full production and even longer to restore product inventories to a comfortable working margin.

The tie-up of major refineries and of many pipe lines and natural-gasoline plants caused a severe curtailment of crude production. Resumption of work would not permit immediate resumption of production of crude oil at prestrike levels because refinery and terminal storage was full. Operators felt that it would be a week or two before production could return to near-normal levels.

Board decision . . . The break in the strike deadlock came when the Wage Stabilization Board approved an agreement between the Farmers Union Central Exchange refinery at Billings, Mont., and the Oil Workers International Union (C.I.O.). This agreement called for an increase of 18 cents an hour in base wages, but the board said it would approve no more than 15 cents.

Labor members of the nine-man board first voted to approve the 18-cent increase, but this was voted down by the other members. The three public representatives then proposed a maximum of 15 cents, and this was accepted by the labor members and so became the majority decision. The three industry representatives continued to insist that under the stabilization rules the board could not approve increases of more than 10 cents an hour.

The 22 cooperating unions originally demanded an increase of 25 cents an hour but after the strike started they indicated a willingness to settle for 18 cents. The Central Exchange contract was one of only a half-dozen submitted to the WSB on the basis of an 18-cent increase.

Shift changes made . . . In the Central Exchange case the WSB also approved the increase in shift differentials asked by the union. Pay for the evening shift, formerly 4 cents an hour over the base rate, will be increased to 6 cents an hour, and the differential for the midnight shift will increase from 6 to 12 cents an hour. All wage increases are to be retroactive to the date of expiration of the previous wage contract.

In Denver, B. J. Schafer, vice president of the O.W.I.U., issued a statement on behalf of the committee of 22 striking unions saying that the group reluctantly agreed to settlement on the basis of the one case approved by the WSB, and asked local negotiating committees to attempt to reach agreements immediately.

"The oil companies still owe us a dime," he added, "and when the day comes that we can bargain free of government interference we're going to get that dime, with interest."

Price effects . . . The interruption in gasoline production, coming at the start of the season of heaviest consumption, caused a stiffening in the refinery price. In the Mid-Continent region the gasoline price had slumped about half a cent per gallon below ceiling prices established by the Office of Price Stabilization.

Last week the price moved up to or very close to the ceilings set for most refiners, and those able to move supplies were finding markets outside of their normal distribution areas. Many major distributors were looking for gasoline to make up for the curtailment of their own production.

The exact amount of gasoline production lost because of the strike will not be known for some time but it is certain that the shutdown has caused a heavy drain on stocks. This fact, plus the higher operating costs incurred by the wage increase, led to predictions that the gasoline market probably will be very firm for some time to come.

Local differentials . . . One big obstacle to immediate resumption of work at all struck plants was the fact that many refiners felt they are not in

position to pay wage increases as large as the WSB will approve.

The 15-cent figure used by the WSB was a maximum, but it was felt that most unions would use it as a minimum when resuming negotiations. Many refineries, particularly smaller ones, have had a poor earnings position recently and may balk at a big wage increase. This is particularly true in the Mid-Continent, where there has been a depressed heavy-fuel market.

Spot-Shortage Plans

Chapman authorizes local fact-finding committees to help solve supply problems; Perlman gives reluctant approval

WASHINGTON. — Appointment of fact-finding committees to make recommendations for dealing with local shortages in the 15 midwestern states was authorized last week by Interior Secretary Oscar L. Chapman, with the approval of the Department of Justice.

Supply directors will be attached to the committees with authority to take such actions as the Petroleum Administration for Defense will direct. They will be either members of the PAD staff or federal, state, or local officials designated by PAD.

Costs of the committees will be met by voluntary contributions from the industry. The set-up is to run for 90 days.

The initial organization will consist of a district committee for all of District 2, state committees for Illinois, Indiana, Michigan, and Ohio, and area committees for Chicago and Detroit. All members will be appointed by Chapman, who announced his intention of personally supervising the program.

The duties and functions of the fact-finding committees may be performed only upon instruction from PAD and are enumerated in PAD Instruction No. 2 as follows:

1. Ascertain facts with respect to the status of petroleum supply, including crude-oil inventories.

2. Ascertain petroleum-product inventories at refineries, terminals, bulk plants, and service stations.

3. Ascertain recent and current rates and methods of movement of petroleum to points of consumption and in instances where the flow is impaired, the reasons therefore.

4. Secure data as to specific areas suffering particular shortages of petroleum, together with the particular petroleum products which may be in short supply.

5. Development information as to the status of supply for relatively more essential uses of petroleum as such uses may be determined by PAD.

6. Make suggestions and recommendations as to the most feasible means of meeting shortage situations and obtaining additional supplies of petroleum in specific areas.

Establishment of the committees was approved with reluctance by Acting Attorney General Philip B. Perlman, who pointed out they do not meet the minimum requirements for the operations of industry advisory committees set up by the department in October 1950.

However, Perlman said, "on the basis of representations made by PAD concerning the seriousness of the emergency, the nature of the functions to be performed by the committees and the limited period for which the committees will operate, I interpose no objection to the issuance of PAD Instruction No. 2."

In a letter to all government departments explaining the cuts in gasoline supplies for nonmilitary flying, Chapman asked a reduction of 65 per cent in purchases of aviation gasoline during the next 4 weeks.

MID-CONTINENT

Unit Law Upheld

Nation's first law requiring unit operation of oil fields in certain situations validated by Supreme Court action

THE nation's first compulsory unitization law has been upheld by the Supreme Court of the United States.

Without opinion, the court unanimously dismissed an appeal from a decision of the Oklahoma Supreme Court upholding the validity of the Oklahoma law. The court noted only that no substantial federal question is involved.

Attorneys stated that the action leaves no question that state legislatures have adequate police power to regulate oil and gas production to promote conservation even by such drastic measures as compulsory pooling of operations, and that these powers may be delegated to regulatory commissions.

Oklahoma's statute, enacted in 1945 and revised in 1951, was the first comprehensive law compelling unit operation of wells in a common source of supply, under prescribed conditions. Arkansas now has a somewhat similar law. Louisiana has long had a law permitting the Conservation Commission, in the exercise of its general powers, to require pooling of condensate fields but not oil fields. Bills similar to the Oklahoma law have been proposed in a number of other states recently.

What was involved . . . The case which went to the Supreme Court involved West Cement Madrano field in Caddo County, the first unit operation ordered by the Oklahoma Corporation Commission, which began operation December 1, 1947.

This common source of supply was estimated to contain 98,000,000 bbl. of oil in place, of which 24,000,000 bbl. would be recovered by ordinary competitive production and 48,000,000 bbl. by unit operation and maintenance of reservoir pressure by reinjection of gas.

More than $1,000,000 has been invested in the gas-injection plant at the West Cement Madrano unit, and five additional producing wells have been drilled since the operation started.

Since this first order, the Oklahoma commission has issued 15 compulsory unitization orders, and about 12 of these plans are now in operation. In states without such laws, unitization must be accomplished by voluntary agreement.

The plan had the approval of the great majority of operators in the field but was protested by Palmer Oil Corp., which owns a 160-acre lease in the center of the field, and by a large group of royalty owners. In two cases, later consolidated for appeal, they fought the unitization plan before the commission and the courts. The Oklahoma Supreme Court upheld the validity of the law and of the commission's order on all counts on March 20, 1951.

Lawyers who have followed the case say it is a complete test of all aspects of compulsory unitization because the protestants objected to practically everything. They challenged geologists' opinions that the field was a common source of supply and engineering estimates of increased recovery from unit operation, and they attacked the procedure on virtually all possible legal and constitutional grounds.

FIRST SIGNATURE on the Scurry unit agreement is being affixed by Phil Yeckel, partner in King, Warren & Dye, Midland. Beside him is M. D. Kirk of Sunray. In back row are, left to right, A. E. Chester, vice president of Magnolia Petroleum Co., Dallas; S. M. Gladney, general manager of the southwest division of Sun Oil Co., Dallas; and W. L. Horner, chief engineer of Sunray and chairman of the SACROC engineering committee.

Scurry Unit Closer

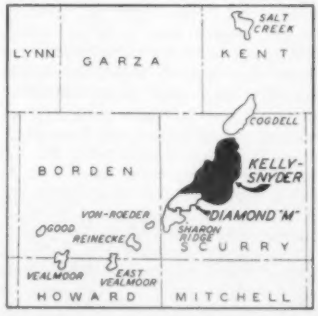
More than enough acreage representation signed, royalty owners now being contacted on pressure-maintenance plan

TULSA. — Lessees operating 84 per cent of the acreage in the proposed Canyon Reef unit in Scurry County have signed the unit operation agreement, and a royalty-owners agreement is now being circulated.

To become effective, the operation must be agreed to by lease owners representing 75 per cent of the working interest and royalty owners representing 65 per cent of the royalty interest.

M. Darwin Kirk, vice president of Sunray Oil Corp. and chairman of the executive committee of the Scurry Area Canyon Reef Operators Committee, said that while the royalty unitization agreement has been in circulation little more than a week, signatures of a large number of landowners and mineral and royalty owners have been obtained. The document is being circulated by SACROC's land committee headed by R. F. Bryant, Jr., Magnolia Petroleum Co., Dallas.

If adopted by a sufficient number of royalty owners and placed in effect, the agreement would unitize all of Kelly-Snyder field and the north portion of Diamond M field (see map).



PROPOSED UNIT is indicated by cross-hatched area.

Operating plans . . . SACROC is planning a gas and water-injection program designed to step up production and increase ultimate recovery from an estimated 20 per cent to about 50 per cent of the original oil in place.

The proposed unit area embraces 47,438 acres containing 1,207 producing wells and is divided into 319 separately numbered tracts. In view of the size of the area, it has been divided into three segments for the project, each of the areas to be operated by a separate segment operator.

Standard Oil Co. of Texas has been designated operator of Segment 1, roughly the north third of the area; Magnolia Petroleum Co. will be operator of Segment 2, the center or northeast third, and Pan-American Production Co. has been named operator of Segment 3, the southeast third of the unit area.

The operating committee plans to employ a unit manager to direct the work on the pressure-regulated system and to correlate the activities of the three segment operators.

Effective date . . . The unit operation will become effective, Kirk said, on the first day of the second calendar month after the required lessee and royalty signatures have been obtained and the unit has been approved by the Texas Railroad Commission.

Kirk said the unitization plan will be submitted to the Railroad Commission "in the near future."

Background . . . Field tests have been conducted in the area over the past 2 years, and results have indicated that a large-scale gas and water injection program would prolong the life of the field and more than double ultimate production.

The tests included water injection in a well of the Lion Oil Co. unit in the adjacent Diamond M area and gas injection in the 6 Webb well of Lone Star Producing Co. in the Kelly area and in the 9-5 Brown well of Standard Oil Co. of Texas in the North Synder area.

Consideration was given unit operation as pressure in the reservoir continued to drop and as the daily allowable sustained periodic reductions.

Since the discovery of the field in 1948, reservoir pressure has fallen from 3,122 psi. to about half that amount, according to SACROC.

Allowables, originally established at 250 bbl. daily, later were reduced to 220 bbl. daily and currently stand at 100 bbl. per well per day.

Gas Case Opens

Gathering-tax arguments are scheduled for June 30

AUSTIN. — The first round in the legal battle between pipe-line firms and the State of Texas over the gas-gathering tax ended last week in no decision.

After a brief district-court hearing in which only one witness appeared, Presiding Judge Jack Roberts set a June 9 deadline for filing of briefs, allowed

2 weeks more for filing answers, and scheduled oral arguments for June 30.

Involved in the legal test is the legality of Texas' gas-gathering tax of .45 cent per M.c.f. on the pipe-line companies. To date, 51 companies have filed protests against the tax, tying up more than $500,000 a month in state revenue. The tax has been in effect since last September.

Only three suits, however, have been prepared for trial. These were selected by attorneys on both sides as representing all questions of law. The companies are Panhandle Eastern Pipe Line Co., first to come before the court, and Michigan-Wisconsin Pipe Line Co. and Amarillo Oil Co.

Panhandle is both an interstate and intrastate mover of gas; Amarillo is limited to intrastate transmission; and Michigan-Wisconsin merely picks up gas near the Texas border for subsequent interstate movement.

A jury trial was waived by agreement between opposing attorneys since no questions of fact are involved.

Only witness at the preliminary hearing was William J. Murray, Texas Railroad Commission member.

WEST COAST

Mud Popularity Poll

Phosphate and phosphate emulsion muds still are tops in California, operators say, with red and lime muds gaining

D. H. Stormont

LOS ANGELES.—Low and high pH red muds and high pH lime muds and the emulsion variations are gaining in popularity in California, but phosphate and phosphate emulsion fluids are by far most widely used.

A survey reported on by A. C. Nestle, of The Texas Co., and H. E. Radford, of Shell Oil Co., at the annual Pacific Coast district meeting of the American Petroleum Institute's Division of Production shows that these phosphate muds are used at depth by some operators in 15 of the 18 fields studied.

The data, representing about 50 per cent of the state's drilling activity, are believed to be a good cross section of industry opinion, the authors said.

Mud practices . . . In many fields, they said, it is common practice to drill the upper portion of the hole with a phosphate mud and when drilling risks become somewhat greater with increasing depth, to convert the mud to an emulsion.

"This is done by some operators who use only a small amount of oil (5 per cent-7 per cent by volume) by simple addition of oil to the mud without any special emulsifier. Those who prefer more oil, 10 per cent-25 per cent, and a lower filter loss, usually add one of the commercial emulsifiers, of which some half-dozen types are available. The type of oil added is most often a relatively light crude, or in some cases stove oil or diesel oil," they said.

"Phosphate emulsion muds are being used as completion fluids in some cases," the paper continued. "One operator for this purpose maintains a filter loss of 1.5 cc. A.P.I. in a mud containing approximately 30 per cent oil and an emulsifier. Another operator adds both oil, emulsifier, and starch to the base mud to serve as a completion fluid and maintains a filter loss of under 3.5 cc.

"A typical phosphate emulsion mud used as a drilling fluid will have properties as follows: Weight 72-78 lb., viscosity 45-60 sec., filter loss 4.0 cc. to 8.0 cc., gel 0 min.-0 gm., gel 10 min.-10 gm., original cost $1.60 per barrel, and maintenance cost 10 to 20 cents per barrel per day. A typical phosphate emulsion mud used as a completion fluid will have a higher percentage of oil and emulsifier and will have properties as follows: Weight 66-75 lb., viscosity 50-70 sec., filter loss 1.5 cc. to 4.0 cc., original cost $1.60-$3.50 per barrel and maintenance cost of 10 to 25 cents per barrel per day."

Improvements wanted . . . While phosphate muds have the advantage of adaptability to standard treatment and relatively low cost, the operators using them would like certain improvements.

As revealed in the survey, they "see the need for a mud which has greater stability at high temperatures and one which will not hydrate the formation and thus require excessive 'watering back.' Contamination is also a problem particularly with cement."

Use of the red muds, they said, has been limited because of their mud making tendency. While lime muds do not make excessive mud while drilling in shale, trouble has been experienced in maintaining stability at all times when contaminated with shale particles.

In completion fluids the speakers said the general trend is toward either oil or oil-base muds, or to use of water-base muds having extremely low filter losses. In the case of the water-base muds, the low filter losses desired are obtained either by high-percentage oil emulsions or by addition of colloidal material such as starch, carboxymethylcellulose, sodium polyacrylate, or a combination of emulsion and colloidal substances.

Diamond coring . . . has become an important phase of drilling operations in California, H. M. Stanier, of Sunray Oil Corp., told the producers and technical men in another session of the 2-day meeting.

Stating that about 150,000 ft. of coring had been done in the past 4 years, with the percentage recovery averaging nearly 100 per cent, he said that much of the coring has been more economical than conventional coring or drilling in hard formations.

Drilling Increase

Shell planning 225 wells for California, Rockies

LOS ANGELES.—Shell Oil Co., California's most active operator with about 35 rigs at work, plans to drill nearly 225 development and exploratory wells in that state and the Rocky Mountains.

Of this total, a record 200 are planned for the company's Pacific Coast area and about 25 development wells are scheduled for the Rocky Mountain region including the Williston basin.

Shell's plans were revealed here last week by H. S. M. Burns, president, on a tour of the company's West Coast installations.

At Ventura Avenue, the company's major California field, 15 rigs are now drilling, in contrast to the 10-string average maintained last year. At Coalinga six rigs are at work and at Brea-Olinda, where Shell found a new deeper zone in 1950, another six are drilling. At the South Mountain properties the company acquired from F. E. Fairfield last year, five rigs are drilling from islands dug into the steep mountainside.

The 25-well program for the Rocky Mountain region, Burns said, points up the importance of the region in Shell's over-all program.

The company plans to have five strings at work in Richey field and two in Pine field, both discovered by Shell in eastern Montana during the past year.

CONTRAST IN COSTS is provided by these two rigs. Rotary in background uses compressed air, drills South Mountain surface holes cheaper and faster than cable-tool rig in foreground.

Lost-Circulation Cure

Shell turns to air drilling to solve mud-loss problems in South Mountain field, halves cable-tool hole costs

D. H. Stormont

VENTURA.—Air drilling has solved a formidable problem for Shell Oil Co.—at half the cost of a cable-tool operation.

Shell's mountain-top field, South Mountain, has virtually defied conventional drilling. Cracks in the highly porous and volcanic formations near the surface in South Mountain field drank drilling mud almost as fast as it was pumped in, making conventional drilling impractical.

In one well, in fact, six cementing operations were required to seal off the cracks during the first 600 ft. of drilling.

Cable tools were tried by Shell, but the method was slow and it was difficult to maintain a straight hole. Also this method required a switch from cable tools back to a rotary rig after the surface hole was drilled.

Shell then changed back to rotary rigs, but substituted compressed air for drilling mud. The lost-circulation trouble vanished, and the company found that it could drill the first 500 to 1,000 ft. of surface hole much faster and cheaper than it could with cable tools.

How it's done . . . South Mountain is so rugged it isn't economical, if not impossible, to drill from single-well locations. So as many as six slant holes are drilled from an "island," with some of the wells bottomed about 2,000 ft. away from vertical.

To date, air drilling has been tried in more than 10 wells on three islands, with successful results in each case. Surface holes which took about a week with cable tools are being drilled in about 1 day.

Current practice is to drill the surface holes for all the wells on an island, moving the rig from well to well. Mud pumps are substituted for air compressors, and the rig then finishes all the holes.

Target of the drill is the 2,000-ft.-thick Sespe oil sand, which lies at a depth of about 4,000 ft.

Nine compressors are used, and these supply 4,180 cu. ft. of air per minute at a pressure of about 100 psi. As the air escapes through the bit nozzles it expands, cooling the bit and blowing the cuttings to the surface. Cuttings are expelled in almost powder fineness through a flow pipe leading away from the derrick floor.

To prevent the fine dust from reaching the drilling crew, a special air pack-off was devised using rubber pipe wipers.

Installed over the top of the 16-in. surface pipe and around the 9⅝-in. casing, and as a packing around the kelly, they force the cuttings through the flow pipe and out to one side of the derrick away from the crew.

Shell acquired most of its South Mountain holdings last year from F. E. Fairfield, who had pioneered the island-drilling technique. The islands are carved out of the flanks of the 2,200-ft. mountain (See photo).

AIR SUPPLY for drilling rig is provided in part by these five compressors. Together with four others, they supply 4,180 cu. ft. per minute at 100 psi.

How to Whip Corrosion

Refiners share latest information on handling of sulfuric acid and amines and protection of tanks at A.P.I. meeting

George Weber

SAN FRANCISCO.—Practical down-to-earth discussions of how several refiners are solving corrosion problems featured a corrosion session at the seventeenth midyear meeting of the A.P.I. Division of Refining here last week.

J. S. Cook of Humble Oil & Refining Co., Baytown, Tex., estimated that 75 per cent of the total steel tonnage in an integrated refinery goes into tankage, and 75 per cent of such steel is subjected to both external and internal corrosive attack.

Cook reviewed several types of coatings applicable to tank interiors and exteriors, presented cost figures, recommended methods for surface preparation and coating applications, and noted service performance.

Coal tar . . . When using coal-tar coatings, a first-class job of application is necessary, else the entire expenditure is likely to be lost, Cook said.

With proper surface preparation, priming, and enamel application good results have been obtained in coating the bottoms and lower 2 ft. of the first shell ring of crude tanks.

Twelve bottoms have been so coated at Baytown since 1946 and inspection of two coatings after 6 years' service showed the coal-tar base to be unaffected, he reported.

Gunite . . . Protection of internal surfaces with reinforced gunite was first begun in 1933. Early applications of ¼-in. unreinforced coats resulted in spalling, thus proving the necessity for steel reinforcement and increased gunite thickness. Properly applied, life of a gunite liner in sour-crude service is unknown, Cook said. Some engineers use 20 years as an estimating figure.

A reinforced-concrete tank bottom for crude or gas-oil service or where the bottom is covered with water represents more than a protective liner, it becomes an integral part of the vessel designed to prevent leakage. Such bottoms are installed when steel is extensively deteriorated and where external corrosion is serious.

Because of excellent impermeability, an air-entrained concrete mix is employed at Baytown. A liquid-type air-entraining agent is added at the batch plant to produce 3 to 5 per cent by volume of entrained air. Of the nine reinforced-concrete bottoms with service up to 6 years, none has failed or required maintenance.

Large-scale tests were made at Baytown applying the first prime coat of exterior tank paints by brush and by spray. Results proved conclusively that application of the first prime coat by brush gave the longest service life. However, after the first prime coat has been applied by brush, no detrimental effects have been observed from the application of additional coats by spray.

Of five types of exterior mastic coatings tested, the combination giving most satisfaction consists of one coat of red-lead primer followed by a heavy coat of an asphalt-base mastic with a finish coat of aluminum paint.

Tank roofs . . . H. F. McConomy and J. J. Hur of Atlantic Refining Co., Philadelphia, arrived at three conclusions during a survey of various materials which could prolong the serviceable life of refinery tank roofs:

1. More consideration should be given to increasing the thickness of steel-roof installations.

2. In cases of severe corrosive condition, aluminum or galvanized-steel replacements may be warranted.

3. Extensive use of roof coatings should not be made until the relatively long service life necessary for their justification is established by actual trial installation in the field.

Girbotol protection . . . Mild steel provides a satisfactory principal material for service in Girbotol units, according to H. M. Wilten of The Texas Co., Port Arthur.

Only when the velocity of the gases and liquids is high may accelerated corrosion or erosion due to the wearing action of the sludge iron sulfide compel remedial measures to be taken, he said. The stripper tower and reboilers are the principal items to watch. If the corrosion rate appears to be excessive, either gunite or 12 to 14 per cent chromium lining should provide a satisfactory solution. The latter lining, however, might not prove satisfactory against hydrogen attack.

Dedicating New Drilling Barges

Some of the men responsible for design and construction of The Texas Co.'s new extra-heavy-duty drilling barge "Gardner" are shown on the rig floor during dedication ceremonies at Orange, Tex., May 10. The barge is 170 ft. long, was designed for drilling below 15,000 ft., and, together with associated drilling equipment, cost $3,000,000. A detailed engineering article on the barge will appear in an early issue of the Journal. In the front row are, left to right, J. F. Martin, J. A. Battle, R. A. Abbott, and B. L. Youngblood. Back row, J. V. Chandler, S. T. McCardell, L. L. Gardner, after whom the barge was named, J. H. Rambin, R. C. Stewart, Ed Malloy, and J. H. Gibbens. All but Malloy, who is vice president of Levingston Shipbuilding Co., which built the barge, are in the Louisiana division of The Texas Co.

Better, Faster Analyses

New techniques for determining stability, flash points, contaminating elements of products discussed by A.P.I.

SAN FRANCISCO.—New techniques affording more accurate and rapid analyses of petroleum products were presented last week in 14 papers during a session on analytical research at the A.P.I. Division of Refining's annual midyear meeting.

Papers principally were divided into groups concerning nitrogen determination and classification, measurement of fuel-oil stability, micro flash-point determination, catalyst analyses, multiple testing, and sulfur compounds.

Nitrogen . . . Because of its deleterious effect on cracking catalysts and its contribution to gum formation, nitrogen in petroleum has become the object of much research.

New analytical titration procedures which will classify specific types of nitrogen bases were outlined in a paper entitled "Determination of Basic Nitrogen in Oils."

The authors, Virginia Z. Deal, Fred T. Weiss, and Theodore T. White of Shell Development Co., Emeryville, Calif., reported that 20 to 40 per cent of the nitrogen present in the petroleum crudes and distillates investigated is combined in the form of basic pyridine-quinoline-acridine types.

The new titration method is also valuable in providing a control analysis of the effectiveness of hydrogenation of oil.

In a report on the work of the A.P.I. subcommittee on nitrogen determination, G. R. Lake of Union Oil Co. of California, said that about 20 laboratories which have cooperated in this work have conclusively demonstrated that nitrogen in petroleum and shale oil may be accurately determined by the Kjeldahl, Dumas, and ter Muelen methods.

The importance of the work lay in determining the pertinent operational variables which must be controlled if accurate results are to be obtained.

While these variables have been known for some time, the limits of variation and the importance of rigid control have not previously been sufficiently emphasized.

Fuel-oil stability . . . J. H. Cromwell, D. Milsom and A. R. Rescorla, Cities Service Research & Development Co., New York, discussed a new accelerated method for determining fuel-oil stability, which reduces the evaluation time from the normally required months to

This method will permit refiners to maintain better day-to-day product control in eliminating filter clogging in fuel-oil burner systems.

Flash-point determination . . . A new technique which duplicates conventional flash-point determination, but uses samples as small as 1/200 of the amount normally required, was discussed by Philip McCutchan and D. A. Young of Union Oil Co. of California.

The apparatus used is simple, inexpensive, and easy to operate.

Micro flash-point determinations now made possible by this method will prove valuable in studying such samples as oil seeps or in investigating flammables associated with accidental fires or explosions, where test volumes are often too meager for conventional analysis.

Multiple tests . . . Savings on the order of $5 to $15 per 1,000 bbl. have been indicated through the use of multiple (instead of single) testing of the product in order to be more certain of the true quality, said M. R. Morrow and C. T. Shewell, Humble Oil & Refining Co., Baytown.

By using multiple testing, said the authors, manufacturing costs can be reduced with the same assurance of producing a satisfactory product.

The study was based on a statistical analysis of the effects of multiple testing on the accuracy of predicting the quality of the product. The basic results are general in nature and are to be applied to other refining problems.

Sulfur studies . . . Polarographic studies show promise as a means for analyzing both free sulfur and sulfur compounds found in petroleum, according to Maynard E. Hall of Humble. The method, employing a mercury electrode, is rapid and sensitive. It is capable of determining sulfur in concentrations of a few parts per million and organic disulfides in concentrations of a few tenths of 1 per cent.

A very rapid sulfur-determination method employing X-ray absorption was discussed by A. Y. Mottlau and C. E. Driesens, Jr., of Standard Oil Development Co., Linden, N. Y. Compared with old methods which consume an hour or more, the X-ray technique gives a determination in about 6 minutes without altering the sample.

The need for greater economics in sulfuric acid due to the critical supply of sulfur calls for better determination of the various components in used sulfuric-acid streams from petroleum processes.

In a review of analytical methods, F. T. Weiss, J. L. Jungnickel and E. D. Peters of Shell Development Co. and F. W. Heath of Shell Chemical Corp., presented methods which have been found particularly useful in the evaluation of spent acid from lubricating-oil treating, gasoline alkylation, and alkylation of aromatic compounds.

Determination described included acidity, uncombined sulfuric acid, sulfonic acids, esters, sulfur dioxide, water, neutral oil, and the equivalent weight of the sulfonic acids.

Catalyst analyses . . . Three methods for determining vanadium in silica-alumina cracking catalyst were compared by five research chemists of Phillips Petroleum Co.: M. D. Grimes, J. E. Puckett, D. M. Goard, H. M. Smith, and B. J. Heinrich.

Although not so sensitive as the colorimetic method, nor as accurate as either the potentiometric or colorimetric methods, they found that the emission-spectrographic method was sufficiently accurate and sensitive for this type of work.

In addition, the latter method was found to be three to five times faster than the chemical methods, which makes it the overwhelming choice for the routine analysis of cracking catalysts which contain more than 0.005 per cent by weight of vanadium.

Also recommending the emission-spectrographic method for measuring the metallic contamination of catalysts, were O. W. Key and G. D. Hoggan of Richfield Oil Corp., Wilmington, Calif.

The method, which is based on measurement of light rays produced with a catalyst subjected to an electrical discharge, will provide analyses of some undesirable elements in concentrations as low as 0.003 per cent, the authors reported.

Smith, Pew Honored

SAN FRANCISCO.—Chester F. Smith, director and vice president of Standard Oil Co. (N. J.) and J. Howard Pew, director and former president of Sun Oil Co., were honored with certificates of appreciation at the refining division's midyear meeting here last week.

David E. Day, vice president of Richfield Oil Co. and secretary of the division's general committee made the presentation at the annual dinner.

a matter of hours.

Warning to Refiners

New air-pollution theory pins blame on refiner; even if not proved, it still will bring investigation, A.P.I. told

SAN FRANCISCO.—A new and as yet unproved theory on nature and cause of air pollution in the Los Angeles area brought forth a warning to refiners here last week that they had better do some checking on their own refineries back home.

Speaking at the seventeenth midyear meeting of the Refining Division of the American Petroleum Institute, Vance N. Jenkins, research supervisor for Union Oil Co. of California, said this new theory will focus the attention of pollution-control boards, politicians, and the public directly on the refineries.

Propounded by Dr. A. J. Haagen-Smit of the California Institute of Technology, it proposes that the bluish-colored, visibility-reducing, evil-smelling, eye-irritating, and allegedly crop-damaging type of air pollution known as smog in Los Angeles is composed of the reaction products of the vapors of primary olefins having five to seven carbon atoms with an oxident, presumably ozone.

Ozone is known to exist at times in relatively high concentrations in the Los Angeles area.

Call for action . . . There are numerous objections raised against this theory by competent scientists who are studying the same problem, Jenkins said. But regardless of its questionable validity, the Haagen-Smit hypothesis has placed refiners generally in a position calling for action.

By action, Jenkins means not only continued research in quest of petroleum's true part in the matter, but individual surveys by refiners to find out exactly what their evaporation losses are, and where they can be reduced or eliminated.

Surveys in Los Angeles indicate that 65 tons of unsaturated hydrocarbons may be released to the atmosphere daily by refiners in the district. The great concern over this is hard to understand when it is known—not estimated—that three to four times that amount is contributed daily by automotive exhausts.

Findings at Los Angeles . . . Refiners over the country may profit from the findings of Los Angeles operators. In a particular case history, Jenkins cited a refinery waste-water skimming-pond system, which showed a daily evaporation loss of 240 bbl. of hydrocarbons in the gasoline-naphtha range.

An equal or larger amount may easily be lost from a relatively small rundown tank at a thermal or catalytic cracking plant if proper precautions are not taken.

Similarly, substantial losses may occur from blowdown stacks, from storage, during unit-shutdown operations, from vacuum jet exhausts, and from many other sources at refining and marketing installations.

What must be known . . . The initial impetus to establish a vapor-loss prevention or recovery program must come from an informed management, Jenkins said. Management must know the answers to these questions:

1. How much vapor is lost from various individual operations, and what is its composition in each case?
2. What is the hydrocarbon-vapor concentration in the air over your plant and over your city?
3. How did you determine the above, and is your method any good?
4. Is the Haagen-Smit theory of smog formation valid and if so, should it be extended in scope?
5. What about the effect of acetylene emitted in automobile exhausts?

These are only samples of the many questions for which refiners had better have good answers, Jenkins said, for the "policeman" is coming, and soon.

Aromatics Papers

Outstanding technical descriptions of design, operation, and performance of five catalytic reforming processes and three aromatics-recovery processes were presented last week during an all-day symposium at the Frisco refiners' meeting on production and separation of benzene, toluene, and xylenes.

Three of these process descriptions may be found in this issue on pages 110-112. Other articles will be published in subsequent issues of Journal.

The industry's assumption of an important role in providing critically needed aromatics is generally conceded to be the biggest petrochemical news of the year.

Catalytic reforming processes described include Platforming, Atlantic Refining Co.'s cat reforming, Houdriforming, Thermofor cat reforming, and fluid hydroforming. The three processes designed for efficient recovery of aromatics include Sun Oil Co.'s Arosorb process, Shell Development Co.'s extractive distillation process, and the Udex process, originated by Dow Chemical Co. and engineered and licensed by Universal Oil Products Co.

Development Rules

Ideal method of bringing in new field outlined in talk

AUSTIN.—How to avoid haphazard development of a new reservoir and obtain most economical production was outlined here last week by M. G. Miller, of J. R. Butler & Co., Houston.

Miller listed six principal rules in his outline of an ideal approach to the development of a new field. His rules, presented before the Texas Petroleum Research Committee, were:

1. Obtain as much information as possible during wildcat drilling in anticipation of the discovery of a producible reservoir. If it strikes oil, set casing, make a production test, and shut it in.

2. Upon completion of the discovery, organize lease owners to sponsor or underwrite (not necessarily unitize) a drilling program to outline the new field. This should be designed to result in a number of dry holes and a few producers. Producers should be tested, completed, and shut in. Dry holes should be left in good condition for possible use later as injection wells.

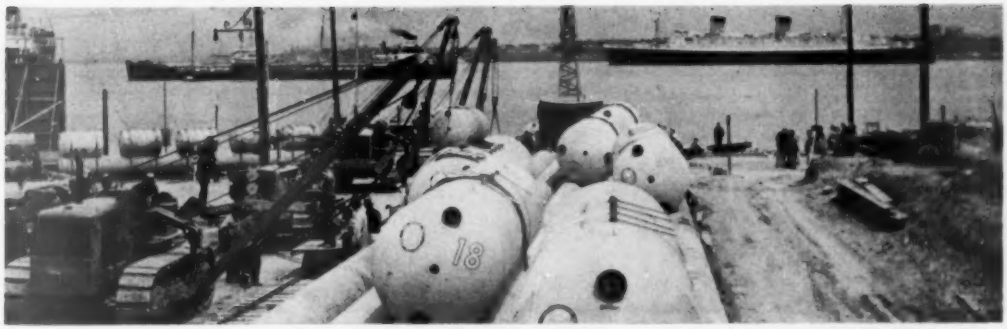
3. Install no lease-tank facilities, but instead lay flow lines from producers to a central point for separating gas, oil, and water and for metering and accounting. If storage is required, stabilize the crude to atmospheric conditions.

4. Install a permanent pressure-indicating device at each well.

5. After the field is completely drilled, undertake to define the continuity of the producing formation to evaluate the capacities of individual wells, then suggest locations for additional in-fill drilling and pressure-maintenance wells. This phase presumably would establish the optimum reservoir producing mechanism.

6. If gas is to be processed, shut in the field while facilities are constructed. In-fill drilling, in which wells are located at places of optimum importance with relation to the encroaching edge water or the advance of the gas cap, can be undertaken at this time.

Miller said per-well flow rates should depend upon what the field as a whole could produce.



S.S. QUEEN ELIZABETH sails through the channel while 6,600 ft. of 24-in. pipe is being pulled along the bottom of the harbor from Staten Island to Brooklyn. A cable on the Brooklyn shore pulled the pipe through a ditch dredged in the harbor bottom.

Crossing the Narrows

By unique methods, Transcontinental pulls a pipe line across New York Harbor without interrupting shipping

Paul Reed

BY a unique method known as submerged flotation, 6,600 ft. of 24-in. pipe was laid across the bottom of New York Harbor last week without interruption to traffic.

The line is the final section in the 1,840-mile system of Transcontinental Gas Pipe Line Corp. bringing natural gas from the Southwest to the New York metropolitan area. A cable from a winch on the Brooklyn shore pulled the pipe through a 25-ft. trench dredged across the bottom of the Narrows, in some places as much as 108 ft. below the surface of the water.

Partial buoyancy was provided by cylindrical pontoons, 38 by 5 ft., designed to offset the weight of the pipe and minimize dragging. These pontoons were cut loose to float to the surface after the pipe was in place. There were no buoys or other obstructions on the surface during the pulling operation.

On the Staten Island shore the 24-in. pipe was assembled in 800-ft. sections. The ¼-in. steel was coated with a ⅝-in. layer of Somastic and jacketed with a 3-in. application of Hevicote, a concrete material weighing nearly 200 lb. per cubic foot.

As each section was welded to the one ahead of it, the line was pulled along a special track and into the water over a self-stabilizing pipe launcher, a new device designed to avoid excessive weight concentration.

The new line is the second Transco connection with New York City, and ties in with the distribution network in Brooklyn and Long Island. The Narrows crossing was directed by Raymond H. Crowe, chief engineer of Transcontinental.

LAUNCHER, used for the first time in this operation, prevents excessive weight concentration as the pipe leaves the shore rails and enters the water. The device is pneumatic operated and self-stabilizing.

PONTOONS, lashed on to control buoyancy, were cut loose after pipe was in place. Buoyancy was carefully calculated to offset the weight of the cement-coated pipe so it would rest lightly on the bottom of the underwater ditch. There was no interference with traffic in the harbor, one of the world's busiest watercourses.

BY TELEPHONE Raymond H. Crowe, Transco's chief engineer, directs the pulling winch across the harbor, watched by J. P. Crawford, assistant chief engineer, and J. S. Dewar of H. C. Price Co.

PANEL PARTICIPANTS at the A.A.P.G. program designed to acquaint students and their parents with the field of petroleum exploration. Each panel member spoke for 10 minutes, after which questions were answered. Members and their subjects were, left to right, Hugh M. Thralls, Seismograph Service Corp., geophysics; Condon MacKay, Carter Oil Co., land, leasing, and scouting; Lloyd Elkins, Stanolind Oil & Gas Co., petroleum engineering; A. I. Levorsen, consultant, discussion leader; and Myron C. Kiess, Mid-Continent Petroleum Corp., geology. For a discussion of the purpose of the panel, see page 185.

Persistent Search

Eastern Gulf Coastal Plain has had a poor success ratio, but geology suggests oil in quantity, Davis tells A.A.P.G.

Philip C. Ingalls

TULSA.—The presence of 15 exploratory crews and 14 million acres under lease in the eastern Gulf Coastal Plain are concrete evidence of the oil industry's continuing faith in oil and gas possibilities of the region in the opinion of Morgan J. Davis, president of the American Association of Petroleum Geologists.

Speaking before a group of the 1,200 geologists attending the Mid-Continent regional meeting of the A.A.P.G. here, Davis, vice president and director in charge of exploration for Humble Oil & Refining Co., Houston, said that the area of slightly more than 100,000 sq. miles comprising all of the land area of Florida and the southern counties of Alabama and Georgia is currently attracting attention as a result of the discovery during recent years of several oil fields in southern Alabama and Florida.

Davis said that the regional structure of this region, which is underlain by Tertiary to Paleozoic rocks that may reach a total thickness of more than 25,000 ft. near the Gulf shore, is a gulfward-dipping homocline interrupted by local structures, the most prominent of which are the Hatchetigbee anticline, Jackson fault, Wiggins and Decatur arches, Ocala uplift, and the South Florida embayment.

The paper presented by Morgan was coauthored by P. H. O'Bannon of Humble's Tallahassee district office. It brought out that though the search for oil in the region started near the turn of the century, activity was sporadic until the discovery of oil in southern Mississippi in 1939.

More than 500 wells have been drilled below 3,000 ft. in the area, but only three oil fields have been found in Alabama (all Upper Cretaceous) and one in Florida (Lower Cretaceous). The 1952 discovery at Pollard, Escambia County, Alabama, is the first field in the area to find light crude oil.

Wide distribution expected . . . Davis said future reserves can be expected to be found widely distributed in the section as indicated by present production in both Upper and Lower Cretaceous beds and oil and gas shows in the deeper Jurassic and shallower downdip Tertiary units.

It has been only in the last 12 to 15 years, he said, that intelligent wildcat well locations have been made and that known structural features of considerable size have been feebly tested.

Lack of success to date on the Hatchetigbee anticline in Alabama and the Ocala uplift in Florida has caused some geologists to "explain" why these structures do not contain oil, but Davis believes that more thorough testing will develop oil-bearing traps due to faulting and porosity wedgeouts.

Davis said that while no single exploratory method used before drilling has proven satisfactory throughout the area, the currently low success ratio of 1 oil well for every 127 dry holes might be improved by restricting a single method to the areas where some degree of success can be expected and by developing new techniques in its application.

Denver-Julesburg basin . . . Some 50 new producing areas have been discovered on the east flank of the Denver-Julesburg basin since the Cheyenne County, Nebraska, discovery by Ohio Oil Co. in 1949, Harry L. Thomsen of Shell Oil Co., Tulsa, told the geologists at this meeting.

Thomsen pointed out that over 50 per cent of the undeveloped acreage in the area is under lease and exploration and development work in the basin accounts for one-third of the activity in the Rocky Mountain region.

During 1951, 213 wildcats were drilled in contrast to 40 in 1949 and 86 in 1950. There are currently 39 seismograph crews operating in the area.

All but one of the new fields are located in one-tenth of the basin's area, the center of the broad, gently dipping east flank of this asymmetrical basin. The odd field is located considerably to the east. The over-all success rate in this basin has been one discovery (oil or gas) for every seven dry holes, and major companies have had an even better success ratio.

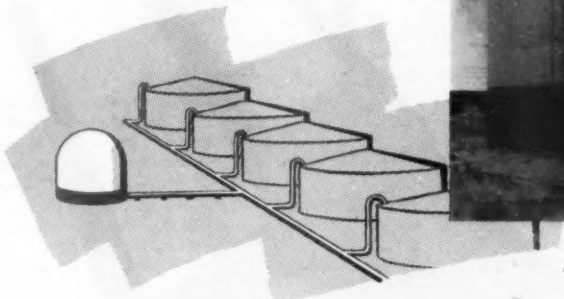
As of April 1 there were 300 producing wells on the east flank of the basin, one-fourth of which had been completed since the beginning of 1952. More than half of these are located in but six fields. Production of both gas and oil is now restricted because of lack of adequate outlet.

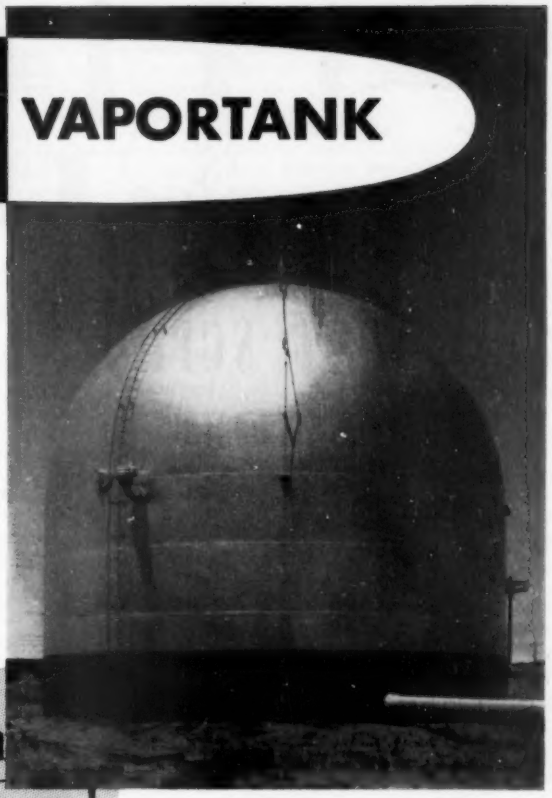
Though all production is now coming from Cretaceous-Dakota sands, Thomsen pointed out that the Pennsylvanian, which rests on basement rocks in the central part of the basin area, and deeper objectives in the northern and southern portions of the basin may play an important role in future development of the region.

Williston basin . . . Estimates of the

the HORTON VAPORTANK

Prevents Evaporation Losses by the Temporary Storage of Vapor





The Horton Vaportank shown above is located at the Cosden Petroleum Company's plant at Big Spring, Texas. It has a 150,000 cu. ft. capacity and is 66 ft. in diam.

The Horton Vaportank consists primarily of a cylindrical shell with a hemispherical top and flat bottom. Inside is a flexible membrane attached to the top of the straight portion of the shell. A vent allows air to flow in and out of the space above the flexible membrane. The space below the membrane is connected to the vapor spaces of several cone roof tanks by lightweight, large diameter vapor piping.

When the atmospheric temperature rises, and the air-vapor mixture in the interconnected fixed roof tanks expands—the extra volume of vapor flows into the Horton Vaportank. The flexible membrane is lifted into the dome to make room for the incoming air-vapor mixture.

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Havana.....402 Abreu Bldg.
Houston, 2.....2119 C & I Life Bldg.
Los Angeles, 17.....1523 General Petroleum Bldg.
New York, 6.....3347—165 Broadway Bldg.
Philadelphia, 3.....1615—1700 Walnut Street Bldg.
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number of wells to be drilled in the Williston basin during 1952 run as high as 250, according to Herbert D. Hadley, Billings Geological Service.

Hadley said very little is known about the rocks of the Williston basin and information acquired from but one well in this sparsely tested region may result in revision of geologic thinking about extensive areas.

The big problem in exploratory drilling in this basin, he said, is recognition of carbonate rock zones that will produce when actual production tests are made but which fail to show up in mud analyses, drill-stem tests, sample study, and electric and radioactivity log interpretation.

Though discoveries to date have been located on long-known structures it is expected that many tests will be drilled to evaluate stratigraphic variations that regional studies indicate exist, he added.

International Compact?

Expansion hinted as Bermudez agrees to adopt Texas rules in jointly-owned fields; public-land problems discussed

Henry D. Ralph

PHOENIX.—Problems of the Rocky Mountain states in developing their oil and gas resources dominated the discussions of the spring meeting of the Interstate Oil Compact Commission here May 9-10, with committee discussions centering largely on public lands and the geology of the "Four Corners" region.

A distinct international flavor was given the meeting by the presence of a number of foreign visitors, and this gave rise to speculation that in time the interstate compact may become an international compact for the promotion of sound conservation practices in the production of oil and gas.

There was a large delegation of top officials of Petroleos Mexicanos, headed by Director General Antonio J. Bermudez and including Alphonso Barnetche, Manuel Rodriguez Aguilar, and Jose Colomo. This was the first time any Mexican official had attended a Compact meeting.

In a speech to the meeting Bermudez made a plea for Western Hemisphere solidarity in developing and depending on its own oil and gas resources, and promised cooperation in this.

"I am addressing 9,000,000 bbl. of oil daily and an enormous amount of gas," he said. "It would be difficult to describe the importance of this great amount of oil and gas to the Western Hemisphere and the world, in its industry, its agriculture, and its all-around well being."

Conservation offer . . . Bermudez made an immediate start toward this cooperation by offering an "informal international compact," saying:

"We have some gas and oil reserves part of which are in the United States and part in Mexico. I agree to apply to those wells on the Mexican side the same conservation principles which you establish on this side. There will, of course, need to be a meeting between the foreign offices of our two countries to work out a formal agreement to this effect."

The suggestion that Mexico may become an official observer at future Compact meetings was also left to diplomatic officials by Bermudez. There is precedent for this in the recent action of Venezuela in becoming an official observer.

Venezuela was represented at the Phoenix meeting by Francisco Medina Olivier of the ministry of hydrocarbons and Carlos Perez de la Cava of the Venezuelan Embassy in Washington. The Province of Alberta, Canada, has been sending an official observer to compact meetings for some time, and recently the Province of Saskatchewan asked and was given the same status.

Public lands discussed . . . Public lands came in for an unusual amount of discussion at the meeting because of the large amount of federal holdings in Arizona and other Rocky Mountain states.

Several amendments to the 1946 Mineral Leasing Law were urged in a resolution presented by the commission's committee on public lands. The most important ones deal with the limitation on the number of acres any company may hold for oil and gas development and with the definition of "primary term" of lease.

Both these matters were discussed at some length in papers presented to a joint meeting of the legal and public lands committees by Hal W. Stewart of Ohio Oil Co., Findlay, Ohio, and Clarence Hinkle, attorney of Santa Fe, N. M.

The present acreage limitation of 15,360 acres of federal lands for a single lessee does not promote conservation, it was brought out. This is because stripper-well acreage in the last stage of production is counted the same as untested wildcat acreage. In such cases an operator must abandon or dispose of producing properties in order to obtain additional land for exploratory work and new development. It was proposed that the limitation be increased to 50,000 acres and that the limitation exclude lands within the structural limits of an oil or gas field or lands which have produced oil or gas for a period of 15 years.

The definition of "primary term" of a lease as used in the 1946 act is causing considerable trouble, the speakers brought out, and the resolution asked Congress to amend it to mean both the fixed 5-year term for which first issued and the period for which it has been extended prior to production.

There are several conditions on which a federal lease may be extended beyond 5 years prior to the discovery of oil or gas, and recent rulings of the Interior Department indicate that extensions will not always have the same conditions as the original term.

Four Corners promising . . . The Four Corners region where Arizona, New Mexico, Colorado, and Utah come together may eventually be proved to contain the nation's most important reserves of natural gas and may as well develop significant production of oil, it was stated at a symposium held on the geology of the region.

Contributors to the discussion included Edwin D. McKee, professor of geology at the University of Arizona; Paul Umbach, consulting geologist of Albuquerque, N. M.; Elvis A. Utz, gas engineer of the New Mexico Oil Commission; and Frank Barnes, consulting geologist of Santa Fe, N. M.

All agreed that exploration in the San Juan, Paradox, and Black Mesa basins has hardly been started in spite of the already considerable volume of gas being produced and the recent encouraging discoveries of oil in several places. It was explained that most of the discoveries to date have been under stratigraphic conditions and that geophysical work must be used much more extensively in this region in the future.

Gas regulation . . . A possible serious conflict between state and federal powers in the regulation of natural gas was noted with concern by the Compact Commission.

This involves a case now pending before the Federal Power Commission regarding gas produced by Northern Natural Gas Co. in Hugoton field in Kansas. As a conservation measure, the Kansas Corporation Commission has set a minimum price of 8 cents per M.c.f. for this gas. Northern Natural

INSERT MAP
This Issue

Don't miss the enclosed special supplement. Estimated producibility of crude and gas liquids through 1955 is shown on a combination map and chart based on information of the Petroleum Administration for Defense report, "Transportation of Oil."

is paying this price for purchased gas in the field and is also paying royalty on this basis for gas it produces itself.

An FPC examiner has recommended that Northern Natural be required to value its own gas at only 2 cents per M.c.f. for rate purposes, and the case is before the full commission for final decision.

The Compact Commission adopted a resolution declaring that: "Should the construction placed upon the Natural Gas Act and said conservation orders be adopted by the Federal Power Commission, takers of gas from the field will necessarily be placed in a position of violating valid orders of the state regulatory bodies concerned, contrary to the spirit and intent of the Natural Gas Act and to the purposes sought to be accomplished by said conservation orders."

The resolution called on the FPC to give full faith and credit to state conservation measures.

Secondary recovery . . . The Compact also voted to make a change in the manner of conducting surveys on secondary-recovery projects so as to drop data on the oil reserves which might be susceptible to recovery by secondary methods.

This action followed protests from a number of oil producers who asserted that the publication of estimates on possible recovery from old fields was being used by lease brokers in bidding up the prices of properties and making it uneconomic for operators to proceed with plans for water flooding.

Featured speakers at the general sessions were the governors of Arizona, Texas, Oklahoma, Colorado, and Arkansas, and Frank Porter, president of American Petroleum Institute.

The compact, said Porter, is the locale of the conscience of all citizens who are truly interested in the nation's oil supply, and it represents the balance between expediency and long-range social benefit. In large measure because of the Compact Commission's work in conservation and secondary recovery, he said, the nation now need have no fear of running out of oil in the foreseeable future.

The fall meeting of the commission will be held in Banff, Canada, September 1-3, and the winter meeting has been set for Wichita, Kans., December 5-6.

Progress in Storage

Capacity of underground caverns increased 33 per cent last year, keeping ahead of gas demands, A.G.A. is told

D. H. Stormont

LOS ANGELES.—Underground storage of natural gas in the United States last year more than kept pace with the demand for gas, registering an increase of about 33 per cent. This activity has now grown to the stature of big business and represents a capital investment of approximately $170,000,000.

A report on underground storage was one of the highlights of the meeting of the Natural Gas Department of the American Gas Association here May 12-13. It was presented by J. V. Goodman of Equitable Gas Co., chairman of the group's new statistics subcommittee.

During 1951 the number of underground storage projects increased from 125 to 142; maximum gas-storage capacity increased from 411,211,000 to 546,076,000 M.c.f.; gas in storage increased from 338,380,000 to 478,825,000 M.c.f.; and ultimate reservoir capacity increased from 766,331,000 to 915,838,000 M.c.f.

The number of wells in storage projects increased from 3,853 to 4,384, the number of compressor stations increased from 83 to 96, and compressor capacity increased from 158,173 to 211,480 hp. As of October 31 last year annual gas input to storage was 337,703,000 M.c.f. compared with 236,596,000 a year previously, and output from storage was 200,355,000 M.c.f. compared with 145,323,000 the year before.

For projects on which data were made available the committee estimated that capital invested in underground storage projects was $97,009,000 at the end of 1950 and $130,266,000 at the end of 1951. An additional $40,000,000 was believed to be invested in unreported projects.

Three types described . . . The session on underground storage included detailed descriptions of three large projects representing different types of conditions. The La Goleta project near Los Angeles, called a "perfect" reservoir because it is a depleted dry-gas field with no hydrocarbon condensates or sanding troubles, was described by R. W. Todd of Pacific Lighting Gas Supply Co.

Experience with a partially depleted oil reservoir, Playa del Rey field near Los Angeles, was detailed by John Reigle, Jr., of Southern California Gas Co.

A third type, one which is currently attracting much attention in the industry because it is a watertight anticline containing neither oil nor gas, is being converted at Herscher Dome near Joliet, Ill., by Natural Gas Storage Co. of Illinois and was described by M. V. Burlingame of that company.

Turbines championed . . . Turbine drives for centrifugal compressors were the topic of chief interest in the transmission session. F. B. Haverfield of Transcontinental Gas Pipe Line Corp. reported that steam turbines are practical and more economical than gas-engine drives.

Three such units, the first ever installed by the gas industry, have been in operation for the past 8 months at a station on the company's 30-in. Texas to New York line. He based his conclusions on comparisons made with 16 conventional gas-engine-driven stations elsewhere on the line.

The steam centrifugal station consists of three 5,000-hp. compressor units, single stage and with a designed maximum operating pressure of 900 psig. They are direct driven by multistage impulse turbines operating at a maximum speed of 5,500 r.p.m. The compressors are piped to operate in series so that the entire gas flow goes through each unit, entering the first compressor at 467 psig. and being discharged from the third unit at 789 psig.

Cost comparisons . . . Comparing Transcontinental's construction costs for the centrifugal station with that of a gas-engine station, Haverfield said the investment for the former was about $45 less per installed horsepower. This he credited to the elimination of massive foundations and to simplified piping, as well as smaller buildings and general plant.

Operating costs for the two types of

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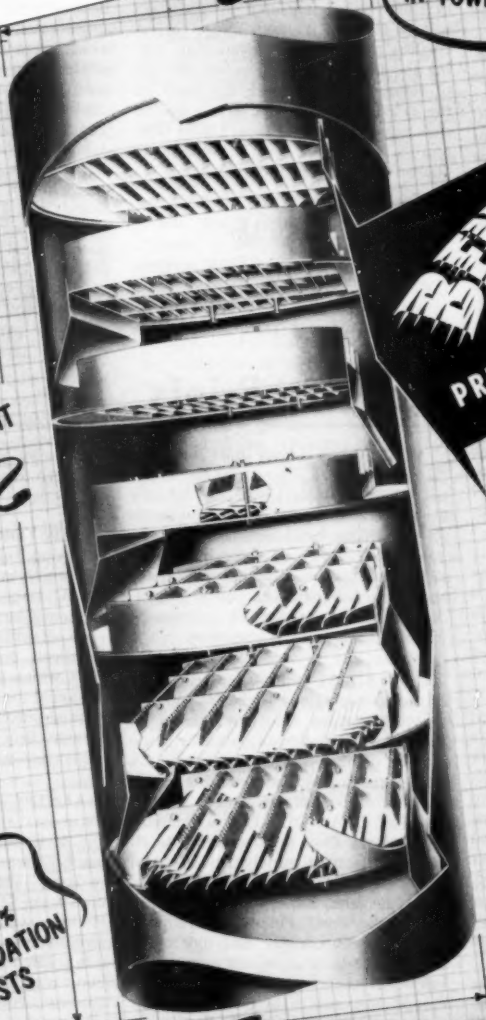

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stations also were compared. On a cents-per-horsepower-hour basis, operating cost of the steam station was 0.1614 cent while that of the reciprocating station was 0.1860 cent. Compared on the basis of cost per M.c.f. of gas pumped, the former was 0.09684 cent per M.c.f. and the latter was 0.11431 cent.

Gas turbine units . . . J. O. Stephens, of the Gas Turbine Engineering Division of Westinghouse Electric Corp., in reporting on the gas turbine's place in gas pipe-line pumping, stated a 5,000-hp., dual-shaft regenerative gas turbine is expected to go on test the latter part of this year. Driving a centrifugal compressor, transmission cost per unit with this new prime mover will be lower than that of a reciprocating-engine-driven compressor, he said.

In this new unit the axial-flow air compressor and high-pressure turbine speed is 6,200 r.p.m. The power turbine and centrifugal gas compressor are direct connected and operate at variable speeds from zero to 7,150 r.p.m. Rated speed is 6,500 r.p.m. Both turbines are supported in the same cylinder so as to provide a minimum of hot-gas ducting.

Fuel consumption for this unit, Stephens said, is 11.5 b.hp. per cubic foot, including all station auxiliaries. Based upon the lower heating value of natural gas this is equivalent to 25 per cent thermal efficiency.

Meter tests planned . . . Accuracy of the orifice meter—the natural gas industry's cash register—in metering gas through large-diameter lines shortly will be investigated by a joint subcommittee of A.G.A. and the American Society of Mechanical Engineers.

A test installation has been prepared on Tennessee Gas Transmission Co.'s trunk line near Refugio, Tex., and work is scheduled to be started about June 2. Multiple 10-in. tubes will be used to check the accuracy of single 30-in. orifice meters. From the work it is hoped that coefficients for the large size meter can be experimentally determined, thereby eliminating metering errors resulting from coefficients being obtained through extrapolations of data based on 14-in. and smaller lines.

As reported by E. E. Stovall, Lone Star Gas Co. and chairman of the joint group, gas from Tennessee's system will pass through a conventional 30-in. orifice flange placed in the 30-in. line leading to the test installation. Gas will be available at about 700 psi. and in volumes of about 550 million cu. ft. daily.

The reference meters will consist of eight 10-in. meter tubes equipped with 10-in. conventional orifice flanges. On the return line a 30-in. special orifice fitting will be installed. A comparison of measurement through the 30-in. conventional orifice flange and the 30-in. special orifice fittings will be made with the measurement of the same gas through the 10-in. reference meter tubes.

Pressures and differentials at all flanges will be obtained by use of high-pressure reflex gages and precision indicating gages. Differential recorders will be installed on each flange for recording pressures and differentials during the test periods. Plans call for use of flange meter pressure taps only on the reference meter but it is expected that pipe taps, corner taps, radius taps, and ⅛ taps will be used in addition to flange taps on the 30-in. tubes.

Foreign Earnings Up

NEW YORK. — Increased earnings from foreign operations account for a substantial part of the greater net income in 1951 of a group of 56 large oil companies, according to an analysis made by Carl Pforzheimer & Co., New York City brokerage and investment concern which for many years has featured oil securities.

While the 1951 earnings of several of the 56 companies were less than in 1950, net earnings for the group as a unit were up 20.3 per cent. The greatest gains came from the companies with large operations in the Middle East or Venezuela or both.

Increased volume rather than prices, which were substantially the same in 1951 as in 1950, accounts for the enlarged revenues and earnings, according to the Pforzheimer analysis. The report shows that approximately 3 billion dollars was spent for capital expenditures last year, making a total of 15 billion dollars since the close of World War 2.

The report explains that in this country total demand of 7,467,000 bbl. daily in 1951 represents an increase of 9.6 per cent, accounted for by an 8.2 per cent gain in domestic demand and a 39 per cent growth in exports.

Industry Briefs

AUSTIN.—A 3-hour short course on "Handling and Running Casing" is being made available to the oil industry by the University of Texas Extension Division. The brief course features a 30-minute sound and color movie, 44 slides, a pressure demonstration unit, and other facilities. The course is conducted by the university's petroleum-industry training staff members.

COLUMBUS, Ohio.—A 3-year study of the technology of sucker-rod pumping is scheduled to begin June 1 at Battelle Memorial Institute under sponsorship of the petroleum industry. A steering committee, now seeking industry-wide support of the project, is composed of L. A. Little, Lufkin Foundry & Machine Co., Lufkin, Tex.; J. R. Mahan, National Supply Co., Toledo; L. A. Ogden, Pure Oil Co., Tulsa; and H. H. Kaveler, Phillips Petroleum Co., Bartlesville, Okla. Purpose of the project is to seek cheaper and more efficient methods of pumping, particularly below 6,500 ft.

WASHINGTON.—President Truman has nominated Thomas C. Buchanan of Pennsylvania for a full 5-year term on the Federal Power Commission. He has been a member of the commission since 1948, when he succeeded former Commissioner Richard Sachse. The nomination of Dale E. Doty, assistant secretary of the Interior, to fill the post vacated by Mon C. Wallgren last fall, has been sent to the Senate floor for approval.

NEW YORK.—Shell Chemical Corp. is buying Julius Hyman & Co., Denver, which manufactures aldrin and dieldrin, important agricultural insecticides, and has obtained exclusive worldwide distribution rights on the two chemicals from Velsicol Corp., Chicago, which holds the patents. Shell has marketed the chemicals since their commercial introduction in 1950. The Julius Hyman firm will continue to operate under that name.

AUSTIN.—The Texas Supreme Court has refused to review Humble Oil & Refining Co.'s suit for an injunction to prevent Montgomery County from raising its mineral-tax valuations from $16,044,710 to $22,509,870. Humble, which said the latter valuation represented one-third of market value, was granted an injunction in trial court, but it was dissolved by the court of civil appeals at Beaumont.

WASHINGTON.—Application of the Union Oil Co. for an increase of 60 cents per barrel in the ceiling price for California crude oil has been denied by the Office of Price Stabilization on the ground no showing had been made that a local shortage of oil existed or threatened.

Boost for Storage

NPC sees great future in use of underground cavities for storing petroleum, recommends studies of sites by states

Bertram F. Linz

WASHINGTON. — Underground storage of oil is practical, less expensive in terms of steel and manpower than conventional aboveground facilities, and can be developed in many sections of the country for stockpiling against an emergency or to meet part of the industry's requirements for increased storage.

These conclusions were reached by a National Petroleum Council committee headed by H. S. M. Burns of the Shell Oil Co. in a report submitted at the April 22 meeting of the council and just made public.

So impressed was the committee with the possibilities of underground storage for crude and products that it recommended that the secretary of the interior invite each state geologist to serve as chairman of a permanent state committee of petroleum and mining geologists and engineers to make detailed studies of local sites which might be developed.

Industry alert . . . The industry already is alert to the possibilities of subsurface storage, Burns commented. A quick survey disclosed that there is under way or in operation underground storage facilities with total capacity of about 7,000,000 bbl.—mainly for liquefied petroleum gases.

"Underground storage of petroleum and petroleum products is feasible and economic, under a considerable variety of conditions," the committee reported, pointing out that a number of such projects now are either in process of construction or in actual operation in the United States and abroad and some of the processes involved are covered by patents or patent applications.

Possibilities . . . The committee found that creation of cavities in salt is feasible in five areas in this country, while in five other extensive areas the only possibilities lie in cavities mined from hard rocks such as granites, lavas, or metamorphics.

More than half the country is underlain by sedimentary rocks in which it would be practicable to create reservoirs by mining in shale and by using existing natural underground reservoirs. Scattered throughout the country are mines and natural caverns which may be adaptable.

"Properly constructed underground storage at suitable sites can, if necessary, meet any foreseeable need for stockpiling of crude oil or finished products, provided the possible effects of contamination, temperature, and time are recognized and compensated for," the committee held.

"Similarly, underground reservoirs could satisfy part of the industry's storage requirements occasioned by normal growth or need for replacement. In certain areas, for purposes of normal expansion of storage facilities, steel might be saved most expeditiously and effectively by constructing underground storage for crude oil and converting existing steel storage to use for products.

"Purely economic considerations may, in many instances, dictate the substitution of underground for storage facilities," the report suggested.

Reservoir preference . . . Weighing the factors of satisfactory operation and economies in steel, manpower and money, the committee listed the preferred types of reservoirs as possibly running in the following order:

1. Cavities dissolved from salt deposits where they have adequate thickness and purity.

2. Existing mines where the problems of sealing are not too great and where there is proper expectation of long-term roof stability.

3. Cavities created by the mining of shale, where the deposits have the necessary strength and freedom from open fractures and contaminants.

4. Cavities created by mining hard rock—having due regard to the possibility that if open fractures exist it will be necessary to seal them from within; that the seals might not prove to be permanently effective; and that an underground reservoir, once occupied by petroleum, would, if damaged, be difficult or perhaps impractical to repair.

5. Traps in naturally permeable rocks such as structural domes and sedimentary lenses. These have the disadvantages of resistance to injection and withdrawal and the possibility of high initial losses when the fluid to be stored is first introduced into the permeable medium.

6. Natural caverns, which may prove in some instances to be readily adaptable to the storage of crude and products of low vapor pressure but which may present very serious problems of sealing, since the presence of a natural cavern indicates permeability of the stratum in which it occurs. This problem would be especially serious in projects involving storage of high-vapor-pressure products.

7. Abandoned coal mines, which are believed to offer relatively little promise because coal normally contains substances that would contaminate finished products to an unacceptable degree, and because coal is a relatively weak structural material and often closely associated with permeable rocks.

Feasibility factors . . . As a guide to further study of the subject, the committee listed the factors affecting the feasibility of underground operations:

1. Important in the economic success of storage in salt formation will be relationship between the cost of drilling to the necessary depth and the size of the cavity it is practical to create at that depth.

2. Essential to the success of any venture is the careful exploration of the site by means of core drilling and intensive study of the recovered cores for the determination of their physical and chemical characteristics and the presence or absence of objectionable contaminants. These operations should be conducted thoroughly in advance of any actual construction.

3. Contaminants likely to be encountered are, among others, sulfur, hydrogen sulfide, hydrocarbon gases, and hydrocarbon residues. While some of these may not harm crude oil, they will in one way or another seriously affect the quality of stored refined products.

It is therefore all-important that any exploration undertaken to establish the geology of a particular deposit include a careful analysis of core samples in order to establish quantitatively the presence of harmful contaminants.

4. Other factors that must be taken into consideration in order to guard against deterioration of certain products are the effects of time and temperature which, even in the absence of oxygen, can cause certain components to polymerize and degrade the performance quality.

5. Reservoir location is another factor with profound bearing on the value of underground storage in that it should

(Continued on page 211)

Tidelands Offer

Chapman promises states a cut if they'll drop claim

WASHINGTON.—A 37½ per cent cut of all revenues from tidelands oil was offered the coastal states last week by Interior Secretary Oscar Chapman if they would forego their efforts to secure return of their titles to the submerged lands.

Chapman made his proposal in an appearance on a television program with Louisiana Senator Russell B. Long at which the tidelands question was briefly debated.

Chapman said he has never acknowledged he has no power to grant leases in the disputed areas but has refrained from doing so because "we would like guidance" from Congress on the question of administration.

The secretary refused to commit himself when asked flatly whether he would attempt to exert that power in the event President Truman vetoed the pending quitclaim bill and Congress failed to override a veto.

Chapman made his offer to the states when reminded that a similar division is made of revenues from the public lands. He said he would be glad to give the states 37½ per cent and put another 52½ per cent in the reclamation fund.

The secretary said that so far some $40,000,000 has been accumulated in the tidelands fund since the Supreme Court decision in the California case and that the revenue was highly important in view of the administration's heavy spending.

CMP Exports Increased

WASHINGTON.—Third-quarter export quotas of controlled materials for use in foreign petroleum operations will be substantially larger than those for the current quarter with the exception of stainless steel and tinplate.

A tabulation of the primary quotas announced by the Office of International Trade for the July-September period as compared with revised quotas for the second quarter shows that foreign oil operations will get 214,500 short tons of carbon steel against 146,000 tons and 12,000 tons of alloy steel against 9,500 tons, but only 25,000 lb. of stainless steel against 1,100,000 lb.

The tinplate quota has been reduced to 12,500 short tons from 14,500 tons for the current quarter, but the allocation of copper and copper-base alloy has been increased to 2,769,000 lb. from 2,044,000 lb. and that of aluminum to 284,000 lb. from 77,000 lb.

A breakdown of the steel allocation shows that in the carbon class foreign operators will get 9,300 tons of structurals in the third quarter against 7,200 tons for the current period; 35,000 tons of plates against 12,700 tons; 40,675 tons of oil-country tubular goods against 38,500 tons; 19,200 tons of welded pipe 16-in. O. D. and over against 33,500 tons, and 110,325 tons of other goods against 54,100 tons.

The alloy-steel allotment includes 8,625 tons of oil-country tubular goods against 6,500 tons and 3,375 tons of other goods against 3,000 tons.

The copper quota includes 1,085,000 lb. of brass-mill products against 836,000 lb. for the current quarter, 1,602,000 lb. of wire-mill products against 1,150,000 lb., and 82,000 lb. of foundry products against 58,000 lb.

WATCHING WASHINGTON

Bertram F. Linz

No Relief Before '54

World demand for sulfur is growing at such a rate that the Government's expansion program, in which the oil industry is playing a major part, will not provide any material relief before 1954.

Total world demand for sulfur this year is estimated by the International Materials Conference at 14,000,000 tons. World production is expected to be 12,300,000 tons, which (while some 500,000 tons more than in 1951) will leave a deficit of around 1,700,000 tons. The 1951 deficit was only 1,272,000 tons, and the Government had hoped that the increased output this year would keep it from increasing.

While the conference has not developed any firm estimates for 1953, it is warning that the outlook holds no great promise of improvement.

Strikes Will Hurt

The effects of strikes in the steel and oil industries may plague the national economy for months to come.

Brief though the last stoppage of steel production was, it is taking a long time to rebuild output to capacity. The oil strike cut deeply into inventories, which will be a long time rebuilding.

Unfortunately, the strikes came at a time when the whole materials situation was rapidly brightening and Government officials were talking of the possibilities of removing all curbs on the use of steel. Now it is questionable whether such action can be taken in the near future.

Steel was only one of several metals which were practically in supply-demand balance. Lead was in easy position, zinc supplies were building up. The only bad spot appeared to be in copper, where delay in the negotiation of a price agreement with the government of Chile was threatening third and fourth-quarter allocations.

It is too early to figure the exact cost of the steel strike, or to anticipate what additional cost would be involved in another strike in the event the Supreme Court holds the President was without authority to seize the industry. Whatever it is, it will be accentuated by the fact that the Petroleum Administration for Defense was using third-quarter tubular-goods allocations to provide steel for operators who were given tickets in earlier quarters which they could not cash at steel mills and which were to be honored in the coming quarter.

Oil Again a Target

The Federal Trade Commission plans a strong campaign to enforce the antimerger act—provided Congress gives them the money.

Under the antimerger provisions of the antitrust laws, the commission is authorized to crack down on consolidations which threaten to create monopoly, reduce competition, or restrain trade but has never had a sufficient appropriation to do what it feels is a complete job.

Right now, the commission is attempting to induce the Senate to add $300,000 to its pending appropriation bill to be earmarked for this cause, in addition to restoring $388,000 cut from its over-all appropriation by the House.

If successful, FTC officials estimate they will have about $500,000 for enforcement in the fiscal year beginning July 1. That is more than they ever have had. The commission has a number of industrial fields marked out as areas of potential monopoly, among them, of course, the oil industry.

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5
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New Price Drive

I.P.A.A. says OPS policy is defeating defense act

WASHINGTON.—A drive for amendment of the Defense Production Act to make it mandatory upon the Office of Price Stabilization to exempt from price control any material in ample supply to meet current needs was launched last week by the Independent Petroleum Association of America.

The desirability of such a provision was urged upon the House banking committee during hearings on extension of the act by Russell B. Brown, general counsel of the I.P.A.A.

Brown charged that a basic purpose of the act to expand the productive capacity of vital defense materials is "being ignored and even defeated" by the policies adopted by OPS. He warned that if this situation continues "there is not the slightest doubt in my mind that this nation will face a shortage of oil."

"In establishing controls generally, they (OPS) have ignored significant parts of the law completely," Brown asserted. "There was no legal authority for establishing present price controls as to petroleum. There is no economic or legal justification for maintaining them."

Shortage danger . . . There is no shortage of crude at the present time, Brown said, but when the supply and demand position is examined in the light of a possible emergency it is apparent the situation does not warrant complacency. The loss of imports, for instance, would impose an additional demand of close to 1,000,000 bbl. a day on the domestic industry, creating a critical supply problem that could be resolved only by the narrowest of margins, if at all.

"In short," he told the committee, "the reserve productive capacity of the domestic industry today is inadequate to insure the nation's safety and provide for its future needs. The seriousness of this situation from a defense and security viewpoint is generally recognized by officials charged with public responsibility as to petroleum supplies."

Brown charged that OPS has given no consideration to the over-all needs of the oil industry and has established no procedure under which they can be considered. Instead, it has maintained a rigid freeze on the general level of crude prices that was set by conditions existing more than 4 years ago. While some provision is made for correcting inequities within the existing price structure no recognition is given to correcting inequities in the general price level.

This policy, he said, is contrary to the historic practice in the industry whereby prices, related and established in all fields and areas by industry-wide economic and competitive forces, move on an industry rather than an individual-producer basis.

Incentives . . . The lifting of price control on oil would provide an incentive for exploration and development which now is lacking, Brown declared, and could be done without danger of inflation under procedures worked out in bills sponsored by Reps. Omar Burleson of Texas and Edward H. Rees of Kansas.

Exports Set New Mark

WASHINGTON.—Exports of major petroleum products again set a new high for the year to date in the week ended April 18, averaging 286,500 bbl. daily against the previous high of 239,700 bbl. daily the preceding week.

The Petroleum Administration for Defense revealed that sharp increases were registered in shipments of four of the five products, with distillate topping the 100,000-bbl.-daily mark. Only motor gasoline showed a decline, dropping to half what it was in the week ended April 11.

Details of exports for the week ended April 18 as compared with the preceding week, and averages for the 4 weeks ended April 18 are shown in the accompanying table in thousands of barrels daily.

	—Week ended— Apr. 18	Apr. 11	Average 4 weeks
Aviation gasoline	56.8	27.1	37.9
Motor gasoline	14.9	29.6	17.8
Kerosine	30.9	17.1	23.0
Distillate	101.6	88.9	72.6
Residual	82.3	77.0	63.3
Total	286.5	239.7	214.6

L.P.G. Men Get Price Relief

WASHINGTON.—Ceiling prices for resellers of liquefied petroleum gas below the retail level have been adjusted by the Office of Price Stabilization to put them on a parity with prices of resellers of other commodities.

In a supplement to Ceiling Price Regulation 17, OPS authorized resellers of "bottled gas" to add to their original ceiling prices the difference between their average laid-down cost during the 3 months ended January 31, 1952, and their average laid-down cost during either the corresponding 3 months ended January 31, 1951, or the calendar year 1950.

Imports Drop

Were down 40,000 bbl. in March, but exports rose

IMPORTS decreased and exports increased in March, according to data released by the Census Bureau of the Department of Commerce.

Total imports into continental United States averaged 894,000 bbl. daily compared with 935,000 bbl. daily in February and 976,000 bbl. daily in January. Crude imports accounted for 28,000 bbl. daily of the decrease over February while product receipts were down 13,000 bbl. daily.

Exports, excluding shipments to territories, averaged 365,000 bbl. daily, an increase of 9,000 bbl. daily over February but 158,000 bbl. daily less than the peak reached last July. The largest increase was reported for crude, up 19,000 bbl. daily from February.

IMPORTS INTO CONTINENTAL UNITED STATES
(Thousands of barrels)

	Mar. 1952	Feb. 1952	Mar. 1951
Crude—			
Mexico	721	775	1,049
Colombia	1,472	1,094	1,504
Venezuela	8,811	8,621	8,550
Kuwait	939	1,650	1,724
Saudi Arabia	1,737	1,723	1,152
Borneo	436	109	325
Canada	70	111	...
Total crude	14,186	14,083	14,304
Daily average	458	486	461
Products—			
Residual fuel	12,750	11,861	10,941
Other products	784	*1,172	748
Total products	13,534	13,033	11,689
Daily average	436	449	377
Total all oils	27,720	27,116	25,993
Daily average	894	935	838

*Revised.

EXPORTS*
(Thousands of barrels)

	Mar. 1952	Feb. 1952	Mar. 1951
Crude—			
Crude	2,939	2,211	2,640
Gasoline	1,896	2,132	1,941
Kerosine	747	216	38
Distillate fuel	1,292	1,642	773
Residual fuel	2,059	1,847	1,077
Lube oils	1,751	1,379	1,534
Other products	630	902	847
Total all oils	11,314	10,329	8,850
Daily average	365	356	285

*Excludes shipments to territories.

MIDDLE EAST

Critical Test

Fifth wildcat in Neutral Zone nearing target depth

THE fifth test in the Neutral Zone in the Middle East is now approaching a critical depth below 4,000 ft.

The well is located a short distance back from the coast about half way between the Kuwait and the Saudi Arabian sides of this wedge-shaped piece of territory.

Exploration men familiar with the Persian Gulf point out that the well should be reaching the Burgan series when it goes below 4,000 ft. These are the Middle and Lower Cretaceous sands which in Burgan field in Kuwait produce at depths of from 4,250 to 4,800 ft.

The Neutral Zone operation is being carried out by American Independent Oil Co. in partnership with Pacific Western Oil Co. General field manager for Aminol, with headquarters in Kuwait town in Kuwait is James MacPherson, who before taking his present position was resident manager for Arabian American Oil Co. in Saudi Arabia.

Aminol, as the operator for the Neutral Zone exploration, has drilled four previous wells, all unproductive. The first, Wafra 1, went to 5,020 ft. It was started December 12, 1949, and was abandoned February 5, 1950. Wafra 2 went to 5,250 ft. and was abandoned June 17, 1950, and Wafra 3, to 5,062 ft., abandoned November 5, 1950. The fourth test, Fuwaris 1, was spudded November 15, 1950, and was taken to 9,398 ft. before it was abandoned March 3, 1951. After the fourth well, the program was held up pending further seismic work.

The new location on the coast now being drilled is a considerable distance away from the four previous tests, which were generally in the northern and western part of the zone. The coastal section took on more interest following the discovery of the offshore Safaniya field in Saudi Arabia immediately to the south of the Neutral Zone boundary.

The Neutral Zone is shared by Kuwait and Saudi Arabia on an undivided basis. American Independent holds the rights from the shaikh of Kuwait, and Pacific Western, from Saudi Arabia. The zone was long regarded as a No. 1 prospect in the Persian Gulf. The Fuwaris well, deepest of four tests drilled to date, found an absence of cap rock and recovered dead oil in the upper sands.

Grangemouth Petrochemical Unit

The unit shown here is a part of one of the few petrochemical plants in Europe. It is the ethylene plant of British Petroleum Chemicals, Ltd., at Grangemouth, Scotland. In the foreground are product storage vessels. The B.P.C. plant began production about a year ago and supplies a range of basic chemicals using petroleum feed stock from Anglo-Iranian Oil Co., Ltd.'s adjoining refinery. The company is owned jointly by Anglo-Iranian and Distillers Co., Ltd.; the recently appointed manager of the Grangemouth plant is Charles Evans, who was formerly works manager for Anglo-Iranian at Abadan in Iran.

I.P.C. Production Rising

Production of the Iraq Petroleum Co., Ltd., group is rising sharply due to the completion of two important new pipe lines during the last 6 months.

One of the lines was the 72-mile project which allowed commercial production to begin last December from Zubair field (operated by Basra Petroleum Co., Ltd.). The other is the recently inaugurated 30 and 32-in. line which gives Kirkuk field a large-diameter pipeline outlet to the Eastern Mediterranean.

For the first quarter, Kirkuk production totaled 2,253,197 long tons or approximately 190,300 bbl. daily. For the first 3 months, the tonnage total, followed in parentheses by the approximate barrel daily equivalent, was: January, 670,745 (164,800); February, 718,161 (188,300); and March, 864,291 (212,000).

Zubair's production for the quarter was 366,855 tons, or about 29,900 bbl. daily. Figures for the month were: January, 61,190 (14,600); February, 114,020 (29,200), and March, 191,645 (45,800).

Slight increases in output also are being made in I.P.C.'s third producing operation, Qatar, operated by Petroleum Development, (Qatar) Ltd. The quarterly total was 738,808 tons (63,400 bbl. daily). Monthly figures were: January, 299,605 (57,700); February, 238,609 (64,300); and March, 270,594 (64,100).

I.P.C. announced annual 1951 pro-

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Says Superintendent Carl Young of the L. B. Jackson Company, Tulsa

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duction for the three areas as follows (figures in long tons): Kirkuk 7,987,024; Zubair, 137,176; and Dukhan (Qatar) 2,332,213.

LATIN AMERICA

System Finished

Santos-to-Sao Paulo lines to begin operating soon

BRAZIL'S first important oil pipe line, the 30-mile system connecting the port at Santos with the industrial city of Sao Paulo, is scheduled to be formally inaugurated this month.

The system consists of an 18-in. for heavy fuel oil and 10-in. for clear products. It was built by the pipe-line department of the government-owned railroad, Estrada de Ferro Santos a Jundiai, and will move products into the Sao Paulo terminals of five foreign-affiliated oil marketing companies.

Later it will take products from the 45,000-bbl. daily refinery now under construction near Santos by the Brazilian National Petroleum Council.

The line was built to relieve the heavily-overtaxed railroad transportation system of Estrada de Ferro Santos a Jundiai. Of the freight carried by the railroad in 1950, 19 per cent consisted of petroleum and products. Completion of the pipe line releases a fleet of about 400 tank cars for service elsewhere in the county.

Construction of the line was made difficult by the steep escarpment lying about 7 miles back from Santos and marking the edge of the plateau on which Sao Paulo is located (*The Oil and Gas Journal, May 5, page 253, and December 20, page 284*).

William G. Heltzel, Tulsa, was consultant on the project, and engineering plans and materials purchasing was done by Williams Brothers Co. except for the 18-in. pipe bought in Germany. Construction contractor was Companhia Tecnica Internacional do Brasil. Cost of the project was approximately $8,000,000.

FAR EAST

New Pakistan Wildcat

The latest wildcat in Pakistan Petroleum, Ltd.'s, exploration program is now drilling in the Chittagong Hill Tracts in East Pakistan.

The well, which is to be taken to 14,000 ft. if necessary, was spudded in recently at a ceremony attended by the chief minister of East Pakistan.

Pakistan Petroleum (Burmah Oil Co., Ltd.) recently completed an unsuccessful test in the Patharia Forest Reserve area of East Bengal and is now engaged in a core-hole program in the Sylhet region.

The Chittagong Hill Tracts well is being drilled in a thickly wooded area of Patiya. The location required the construction of a road through hilly jungle with a dozen bridges of capacity of 20 tons or more. About 5,000,000 cu. ft. of earth was moved in preparing the site for the well and auxiliary buildings.

B.O.C. Mission in Pakistan

A three-man mission of refinery and marine officials of Burmah Oil Co., Ltd., arrived in Karachi, Pakistan, early in May to study the technical aspects of the proposed construction of a refinery in Karachi and especially the question of a suitable site.

The three company officials are S. C. C. Thomson, J. Handerson, and R. Cook. They will work with a group of Pakistani government officials and later report back to their company.

B.O.C. last March offered to erect a refinery at Karachi as a result of discussions between the Pakistan Government and W. E. V. Abraham, managing director of B.O.C. At the time, capacity of the suggested plant was placed at about 10,000 bbl. daily.

B.O.C. operates in Pakistan in the exploratory field through Pakistan Petroleum, Ltd., and has developed minor production near one of the Punjab fields. One present refinery in Pakistan is Attock Oil Co., Ltd.'s, 4,800-bbl. daily plant which handles the small indigenous production from the Punjab fields.

EUROPE

Marine Fuel-Oil Price Up

Prices of marine fuel oils at European and Mediterranean ports were increased last week by amounts equivalent to from 13 to 20 cents a barrel.

Esso Export Corp. announced higher prices effective May 6, following similar increases made earlier by Anglo-Iranian Oil Co., Ltd.

The increases were due to higher contract tanker rates made before the recent decline in the spot market and to continued high-cost movements of these products from distant locations due to the shutdown at Abadan in Iran.

International Briefs

Kuwait Oil Co., Ltd., is now reported to be completing its third well in the new Magwa extension to Burgan field. The first Magwa well came in last fall about 7 miles to the north of the north end of Burgan. The company as yet is running one rig in the Magwa area, along with the two development strings in Burgan proper. The extension holds the promise of adding 10,000 to 12,000 acres or more to the present approximately 65,000-acre aerial extent of the field.

The Gulf organization is making preparations to ship a rig out of Houston to commence its first drilling on its concession in Mozambique in Portuguese East Africa. The rig is due to reach Mozambique about July 1. Mozambique Gulf Oil Co. obtained the concession in 1948 over some 45,000 sq. miles in the southern part of the country, and since that time has been doing geophysical and geological work.

Oil-industry equipment is included in the machinery which the Russians have told the Argentines the Soviet Union can supply in a trade deal between the two countries. This was reported by Dr. Jose M. Rivera, Argentine official, following his return to Buenos Aires from the recent international trade conference which the Communists sponsored in Moscow. Dr. Rivera said the Russians were interested in supplying the machinery particularly in exchange for large quantities of Argentine wool.

The fifth tanker in a program for the construction of 11 such vessels in the United Kingdom has been launched for Overseas Tankship (U.K.), Ltd. (Caltex). The latest launching was of the Caltex Liverpool, built by R. & W. Hawthorn, Leslie & Co., Ltd., of Hebburn-on-Tyne, England. It has a deadweight of 17,000 tons.

Storage and equipment for handling up to 200,000 tons of petroleum and products (about 1,400,000 bbl.) are being ordered abroad by Israel Fuel Corp., Ltd., the new Israeli Government-sponsored national oil company. The company's program includes laying a 6-in. products line from Haifa to Tel Aviv, importation of crude for refining at the now partially shutdown Haifa refinery, and the importation and distribution of products needed locally.

PERSONALS

New Atlantic Head

Supplee was sales expert before joining company

HENDERSON SUPPLEE, JR., 48, newly elected president of Atlantic Refining Co., joined the company in 1947 following wide sales experience in other industries.

Supplee, who will serve as the firm's chief executive officer, joined Atlantic as vice president and general manager of domestic sales. In 1948 he was elected to the board and in May 1949 he was named executive vice president.

He was born in Philadelphia and was educated at the Episcopal Academy, Princeton University, and the University of Pennsylvania School of Finance.

Before joining Atlantic Supplee was president of the Supplee-Wills-Jones Milk Co., Philadelphia, of which he will remain a director. Other positions include that of charter trustee of Princeton University, a trustee of the Episcopal Academy, director of the United Fund of Philadelphia, a member of the board of managers of the Philadelphia Saving Fund Society, and a member of the board of managers of the Fife-Hamill Memorial Health Center.

J. A. Cleverley, Bartlesville, Okla., has been appointed manager of the production division of Cities Service Oil Co. (Del.). He succeeds **M. J. Kirwan,** who has retired but will continue to serve the company in a consulting capacity. **C. E. Beecher,** Bartlesville, who has been general superintendent of the division, has been named director of production research and development. **C. R. Smith,** assistant division superintendent at Odessa, Tex., will be transferred to Bartlesville as general division superintendent.

Walter R. Reitz, Oil City, Pa., formerly executive vice president, has been elected president of Quaker State Oil Refining Corp. He succeeds **Samuel Messer,** Oil City, who retired and was elected vice chairman of the board of directors. **F. O. Koontz,** Oil City, general sales manager, was elected vice president.

Sid A. Keefover, formerly production superintendent for Olson Drilling Co. at Burrton, Kans., has joined E. K. Carey Drilling Co. and E. K. Carey Contractors, Denver, as production superintendent. Keefover will be in charge of all Carey's production throughout Kansas and will be located in the company's branch office at McPherson, Kans.

Alec Crowell has dissolved Natural Gas Associated Consultants, New Orleans, and formed Crowell Oil & Gas Exploration Co., which will specialize in drilling farmouts.

W. H. Farrand, manager of the producing department, Western Hemisphere, has been elected vice president of Texas Petroleum Co. and affiliated Texaco companies in Latin America. He succeeds **J. P. McCullough** who has moved from The Texas Co. to become vice president of American Overseas Petroleum, Ltd., the joint Texaco-Standard Oil Co. of California company which handles exploration in the Eastern Hemisphere. Farrand is now manager of foreign production for the Petroleum Administration for Defense in Washington. He is due to return to his position with The Texas Co. about June 1.

E. J. Hamner and **John S. Bell** have been named manager and assistant manager, respectively, of Humble Oil & Refining Co.'s operations in California. Hamner joined Humble after receiving a master's degree from the University of Oklahoma in 1932. He was promoted to assistant chief geologist at Houston in 1946 and made manager of exploration in California in 1948. Bell, who has been with the company since 1933, became district petroleum engineer for Southwest Texas and came to California in 1951 as district superintendent.

B. J. Sinex, Jr., district engineer for Amerada Petroleum Corp., has been transferred from Monument, N. M., to Williston, N. D.

Ben F. Hartman, assistant manager of the process-promotion division, Socony-Vacuum Laboratories, Socony-Vacuum Oil Co., Inc., New York, has been named technical director for the company's Augusta, Kans., refinery, effective June 15. He will succeed the late Emory Skinner.

J. Howard Marshall, former president of Ashland Oil & Refining Co., has been elected a director of Signal Oil & Gas Co. He will be in the company's division office at Fort Worth and will be in charge of exploration in the Mid-Continent area.

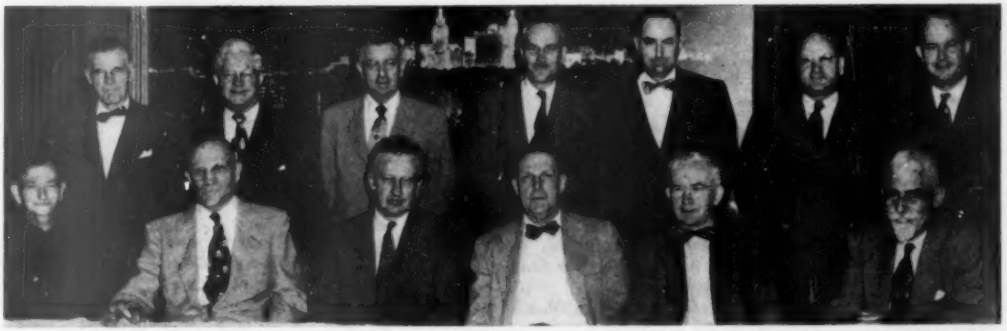
Ross M. Phillips, formerly district geologist for British-American Oil Producing Co. in the San Joaquin Valley, has opened consulting offices as a geologist and petroleum engineer in Bakersfield, Calif.

Albert I. Ingham, Pittsburgh, has been appointed chief geologist for Peoples Natural Gas Co. Prior to joining Peoples in 1951, Ingham was geologist in charge of southwestern Pennsylvania for the Pennsylvania Geological Survey and had worked for Shell Oil Co. in Texas, Louisiana, and Florida. He received a master's degree in geology from Cornell University in 1939.

W. Howard Myers has resigned as chief geophysicist for Union Oil Co. of California to enter consulting work in Calgary, Alta. Prior to joining Union he was manager for United Geophysical Co. of Canada and Alaska.

R. O. Turner, formerly vice president of Camay Drilling Co., has been elected vice president of Southern California Petroleum Corp., Los Angeles, following consolidation of the drilling concern into the parent company. He will continue to manage the Camay division's contracting operations. **W. E. Mannon** also was elected vice president of Southern California Petroleum and will head its engineering and geology departments. **E. E. Stone** was appointed assistant secretary of the company.

PERSONALS



Presidents Honored

This group of presidents of the Tulsa Geological Society was honored at a special program May 9. Front row, left to right, are: Frank C. Greene, Missouri Geological Survey; Albert L. Beekly, Mid-Continent Petroleum Corp., consultant; A. I. Levorsen, consultant; Frank R. Clark, formerly of Ohio Oil Co.; Edward F. Shea, Stanolind Oil & Gas Co.; and Edward Bloesch, consultant. Standing, left to right, are: Robert J. Riggs, consultant; Robert H. Wood, Broswood Oil Co.; John L. Ferguson, Deep Rock Oil Corp.; Charles G. Carlson, consultant; Jerry E. Upp, Sinclair Oil & Gas Co.; Louis H. Lukert, The Texas Co., and V. L. Frost, Ohio Oil Co., current president. With the exception of Greene, who lives in Kansas City, all reside in Tulsa. Frank Clark, general chairman of the Mid-Continent Regional meeting of the American Association of Petroleum Geologists held in Tulsa May 11-13 was presented an honorary membership in the society at this meeting.

H. H. Carrick has been transferred from Taft to Vernon, Calif., where he is assistant to the superintendent of General Petroleum Corp.'s southern production division. **J. J. Browne** replaces Carrick as assistant to the superintendent at Taft.

J. W. Sandberg, formerly with the Perco division of Phillips Petroleum Co. at Bartlesville, Okla., has been appointed refinery manager of the Lakeside Refining Co. plant at Kalamazoo, Mich. Before joining Phillips he spent 2 years with North Star Oil, Ltd., of Winnipeg, Canada, and 6 years with Trinidad Leaseholds, Ltd., at Pointe-a-Pierre, Trinidad, B.W.I., in refinery operations.

Claude D. Gaines, division engineer for Sinclair Oil & Gas Co., has been transferred from Tulsa to Fort Worth. Other changes announced by the company's production department include: **C. L. Ellis,** district foreman at Taft, Tex., transferred to Damon, Tex.; **Byron L. Plumley,** intermediate petroleum engineer, Delaware, Okla., promoted to senior petroleum engineer and transferred to Ardmore, Okla.; **F. F. Thomason,** district foreman, Pampa, Tex., transferred to Big Spring, Tex.; **Golbert L. Price,** junior petroleum engineer, Oklahoma City, Okla., transferred to Lindsay, Okla.; **James A. Shelton,** junior petroleum engineer, Gainesville, Tex., promoted to intermediate petroleum engineer and transferred to Midland, Tex.; **C. L. Brown,** district foreman, Russell, Kans., transferred to Royalty, Tex.; **E. V. Gunn,** construction foreman, Midland, Tex., promoted to district foreman and transferred to Stafford, Kans.; **Ira L. Wagner,** assistant district foreman, Arp, Tex., transferred to Crane, Tex.; **Troy C. Kadel,** district foreman, Crane, Tex., promoted to assistant district superintendent, and **Robert A. Bonnell, Jr.,** senior petroleum engineer, Odessa, Tex., promoted to district foreman, Crane, Tex.

W. R. Johnston, formerly senior petroleum engineer for Humble Oil & Refining Co. at Houston, has been transferred and promoted to supervising petroleum engineer at Midland, Tex.

Disque Deane, New York City, and **Brig. Colin Campbell,** Toronto, have been elected directors of a new company, Canadian Decalta Gas & Oils, Ltd., formed from the former company, Decalta Oils, Ltd. Deane, associated with Union Securities Corp. of New York, also was elected chairman of the new company's finance committee.

Dave Matthews, Mount Pleasant, Mich., has resigned as petroleum engineer with the Michigan Department of Conservation, geological-survey division, to join the geological staff of Dow Chemical Co. He is attached to the Brazos Oil & Gas Co. offices at Roscommon, Mich.

W. C. Cameron, Bert Sargent, and **R. L. Sisler,** all members of Coast Counties Gas & Electric Co's pipeline division, have been transferred to the company's operating headquarters at Concord, Calif., following the removal of that division from Pittsburg, Calif.

Kenneth R. Joynt has been promoted from assistant district superintendent of Magnolia Petroleum Co.'s Vanderbilt producing district to district superintendent. He succeeds the late C. G. Worthy.

Joe Lindsay, production geologist for Carter Oil Co. at Grand Rapids, Mich., has been transferred to the company's central division offices in Oklahoma City.

Art J. Heiser and **Don W. Green,** formerly engineer and drilling superintendent, respectively, for Brown Drilling Co., Long Beach, have resigned from the company to establish Green & Heiser Drilling Co. with offices in Bakersfield. **Newell Hunnicutt** has taken over Green's former duties as drilling superintendent and **R. C. Walker** was made Brown's petroleum engineer.

Maurice Kamen-Kaye has been appointed consulting geologist for Canadian Devonian Petroleums, Ltd., a recently formed Regina, Sask., company. He will set up a geological department and supervise the company's

PERSONALS

exploration program in Saskatchewan. Before 1950 he worked for Caracas Petroleum, S. A., in South America, serving as chief geologist for Caracas for 10 years in Venezuela and Peru.

Alan Curtis, Pure Oil Co. geologist at Clare, Mich., has been transferred to Pure's Bismarck, N. D., offices.

PAUL L. LYONS

Paul L. Lyons, exploration manager for Anchor Petroleum Co., Tulsa, has been elected president of the Geophysical Society of Tulsa. He is editor of Geophysics, quarterly publication of the Society of Exploration Geophysicists. Other new officers are: **L. Y. Faust,** Geophysical Research Corp., first vice president; **William B. Agocs,** consultant, second vice president; **D. R. Davis,** Industrial Electronic Supply Co., secretary; and **Francis H. Cady,** Carter Oil Co., treasurer. **E. V. McCollum,** E. V. McCollum & Co., is the new district representative to the national committee. **Reese H. Tucker,** Cities Service Oil Co., and **R. G. Piety,** Phillips Petroleum Co., both of Bartlesville, continue to represent the Tulsa region for the S.E.G.

R. E. (Bob) Rogers has been named district geologist for Skelly Oil Co. in Shreveport where he will supervise operations in Arkansas, North Louisiana and East Texas. He succeeds **Michael Beckman,** who resigned to become chief geologist for Natural Gas & Oil Corp.

R. P. Knapp, senior petroleum engineer for Humble Oil & Refining Co., has been transferred from the London district, East Texas division, to Houston.

Bill Garms is manager of a new Rocky Mountain division office at Denver of Geological Well Service Co., Abilene, Tex. **E. G. (Ty) Dahlgren,** Oklahoma City, and **Forrest Kinser,** Fort Worth, are managers of other new division offices.

J. H. Wishnick has been appointed manager of the newly-organized oil-black division of Continental Carbon Co., which has a carbon plant at Sunray, Tex., and an oil-black plant at Westlake, La. **R. A. Reinke** has been appointed general superintendent.

Richard A. Baile has resigned as seismograph supervisor for Stanolind Oil & Gas Co. at Midland, Tex., to become vice president of Empire Geophysical, Inc., Fort Worth.

C. A. Brooks has been named area exploitation engineer at New Orleans for Shell Oil Co., replacing **L. P. Layman,** who recently was transferred to Shell's Franklin division office. Brooks formerly was a division exploitation engineer for Shell at Lake Charles, La.

Louis A. Panzer, formerly crew foreman for Northern Natural Gas Co. at Mankato, Minn., has been appointed district foreman of the South Omaha district of the Lincoln pipe-line division. He replaces **Ralph Cotton,** who was transferred to Clifton, Kans., as division superintendent.

E. E. Beeman, district geologist for The Texas Co. in Wyoming, has been transferred to Lewiston, Mont., replacing **K. R. Parsons,** who has resigned. Other company changes include: **A. O. Saterdal,** district geologist at Salt Lake City, transferred to Casper, Wyo., and **R. E. Hunt,** promoted from geologist at Denver to district geologist at Salt Lake City.

Samuel D. Blowitz has been elected president of Eureka Co., Long Beach, in a reorganization move. Other officers are **W. K. Wilson,** vice president, and **E. Sterling Ferguson,** secretary-treasurer.

Charles M. Rood has been appointed southwestern division engineer for Sohio Petroleum Co. at St. Louis. He joined Sohio in 1949 as a junior engineer in the operating section of the St. Louis office.

W. J. (Bill) Seidl, district geologist for Kerr-McGee Oil Industries, Inc., at Shreveport, will become southern division geologist at New Orleans effective June 1.

D. G. Kingman, San Joaquin division superintendent for the production department of General Petroleum Corp., has been promoted to assistant manager of joint-venture operations. He will be located in Los Angeles.

DEATHS

Frank C. Fyke, head of material, inspection, and expediting in the engineering division of Esso Standard Oil Co., died May 10 at Cranford, N. J. He had been with Standard since 1918.

Lou G. Stogner, 67, Fort Worth, independent oil operator since 1938, died May 9 at Fort Worth.

Dr. Joseph A. Sharpe, 45, Tulsa, president of Frost Airborne Survey Corp. and vice president of Frost Geophysical Corp., died of a heart attack at his home May 9. He formerly was chief physicist for Stanolind Oil & Gas Co. and had been with Frost concerns since 1945.

Benedict Saurino, 47, manager of Sun Oil Co.'s statistical research division, died May 9 in Philadelphia following an illness of several weeks. He joined Sun Oil Co. in 1936 as a statistical economist in the Philadelphia general office. As tanker consultant to the Petroleum Administration for Defense, he spent much of last year in Washington helping prepare PAD's comprehensive report, "Transportation of Oil."

Darwin Henry Strong, 80, retired construction engineer for the Los Angeles Gas & Electric Corp., died recently in Los Angeles.

John A. Murphy, 78, president of Murphy Oil Co. of Pennsylvania since 1919, died May 9 in Philadelphia. About 6 months ago he organized Murphy Oil Co. of Oklahoma, a company subsidiary with offices in Tulsa.

Christian H. Seger, 74, who had dealt in oil leases since retiring from banking in 1929, died May 13 in a Tulsa hospital. He was the father of Christian H. Seger, Jr., Tulsa, treasurer of Bethlehem Supply Co., and Joseph L. Seger, Shreveport, La., president of Interstate Oil Pipe Line Co.

John C. Berlin, 92, president of Edenburg Oil & Gas Co., died May 12 at Erie, Pa. He had been associated with the oil and gas business since he was 18 years old.

John Henry Tucker, 43, president of Wells Service & Drilling Co., Houston, died in Corpus Christi May 8 of a cerebral hemorrhage.

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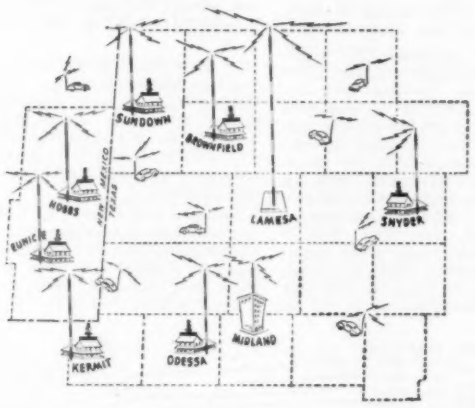

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WHERE ELSE CAN YOU MATCH THIS KIND OF SERVICE?

A geologist looks at the possibilities of

Oil and Gas in the Paradox Basin

by J. L. Tatum

PARADOX basin is defined as that area in which the Paradox member of the Hermosa formation of Pennsylvanian age is known to be present.

The Uncompahgre uplift (see J. L. Borden's map, Fig. 1) is probably the oldest and the most influential of the positive elements affecting the basin. Uplift of the Uncompahgre certainly started as early as the formation of the salt and there is some evidence it may have begun before Mississippian time. It has many points of similarity to the Amarillo uplift and probably was contemporaneous with it, if not actually a part. Its conception may have been pre-Cambrian.

Anticlinal Structures

Bordering the Uncompahgre to the southwest is a long, narrow trough in which are a series of long and steeply folded anticlines, each of which is pierced by salt along its crest. Paralleling these to the southwest is the Glade-Egnar-Libson Valley fold. This anticline is unusual in that it has a gentle and remarkably smooth southwest slope and steep and irregular north slope grading into a fault at Libson Valley. It seems probable that this may be a fault, at depth marking the south limb of what we here call the Paradox graben. The Big Flat arch may be a continuation of this feature. The folds within a graben of this nature must have been initiated with the beginning of the graben.

Age.—William Lee Stokes, University of Utah, proves that at least Gypsum Valley anticline was growing through Cutler to Cretaceous time. Along the Dolores River where it leaves Gypsum Valley there is a sharp angular unconformity within the Hermosa, so it seems likely that the structure was growing during at least part of Hermosa time.

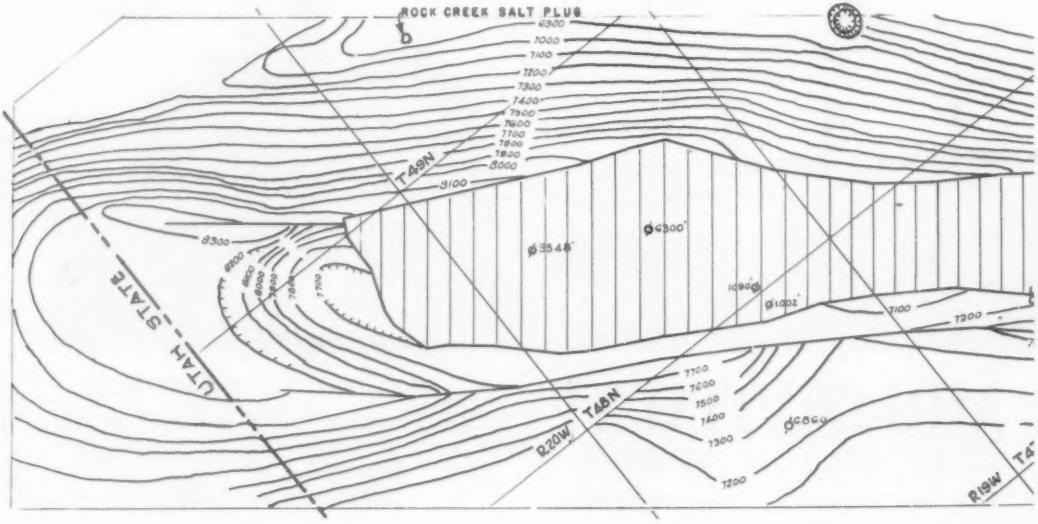
Should the growth of these salt structures during Hermosa time be established it will probably result in the discovery of commercial oil along the flanks of at least some of them.

Evidence of faulting.—The alignment of the east ends of Glade, Gypsum Valley, and Paradox with the axis of the Nucla nose is unusually straight and suggests the eastern termination of the Paradox graben against a deep-seated fault. The group of mountain-like structures, Rico, La Plata, and San Juan, have evidence of frequent though small movements during Pennsylvanian time. This is evidenced by numerous small angular unconformities, some erosional, which can be seen from the highway both in the Hermosa cliffs and in Coal Bank hill. The Turner-Buss well south of Norwood, Colo., has a much thicker than expected Pennsylvanian section with only a few anhydrite beds and no salt. The fold on which this well is drilled is approximately on strike with the axis of the Paradox anticline.

Paradox anticline.—Fig. 2 is a reconnaissance structural map of the Paradox anticline. In constructing this map no attempt has been made to show the numerous small faults on the south flank and in the depression

THE AUTHOR

J. L. Tatum, independent geologist of Albuquerque, N. M., received his B.A. degree in geology at Oklahoma University in 1919. He was chief geologist for Marland Oil Co. of Mexico, 1925-34, and for Plymouth Oil Co. from 1935 until 1945 when he became an independent geologist in the "Four Corners" area of the Rockies. Paper presented at second annual meeting of Rocky Mountain Section, A.A.P.G., Salt Lake City.



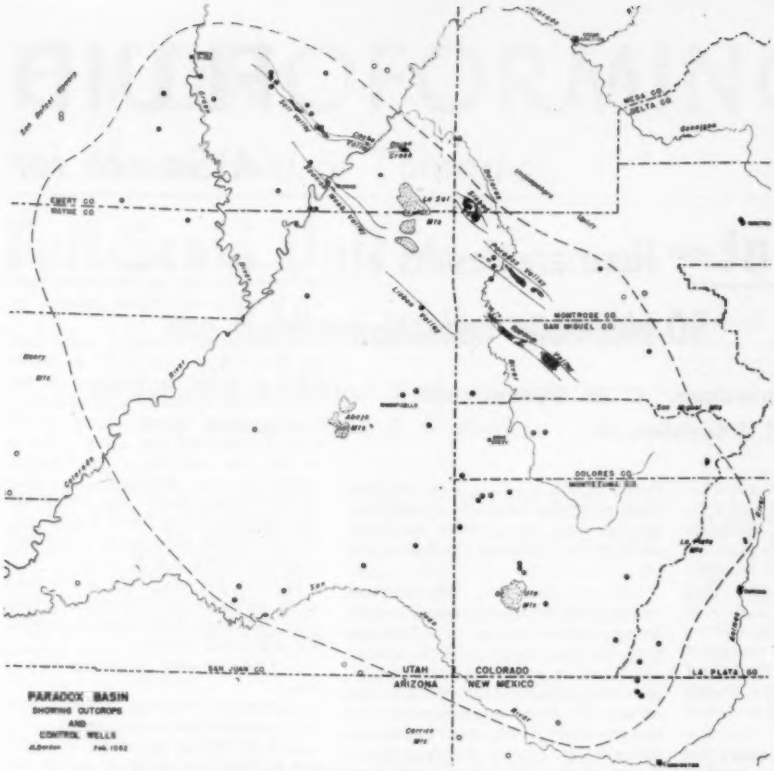


Fig. 1—Left: Map of Paradox basin prepared by Joseph L. Borden, Pure Oil Co., Durango, Colo. This map, prepared in February 1952, shows outcrops of the Paradox member of the Hermosa and control wells.

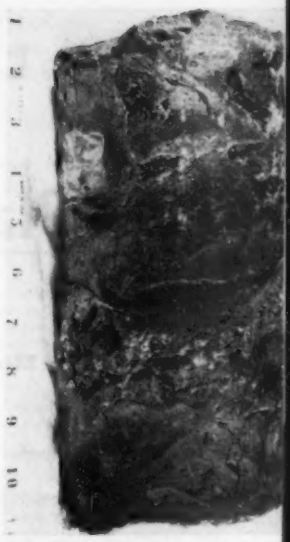


Fig. 3—Vugular Pennsylvanian limestone core, bleeding oil, from Hathaway State Line well in central portion of Paradox basin, Colorado, at 5,495-5,512 ft.

over the axis on the west end. Many of these are in the nature of land slides; all were doubtless formed either by solution or post-Cretaceous movements of the salt.

It is interesting to note the depressions along the axis on either end of the anticline. Both are obviously post-Cretaceous in age as is the steeply folded anticline south of the eastern basin. There is exposed a cross-section of the crest of a sharply folded anticline in beds of probable Cutler age which has been truncated and overlain with gently dipping beds, probably of Moenkopi age. This is not shown on the map but may be seen on the east bank of the Dolores River about 1 mile from the mouth of the canyon. The circular depression on the north flank is probably due to the leaching of a small pre-Wingate salt plug. On Rock Creek, near the east end of the syncline separating Paradox and Sinbad anticlines, it is a small salt plug in which Paradox beds are exposed. This is at the intersection of two small faults, and covers less than 20 acres.

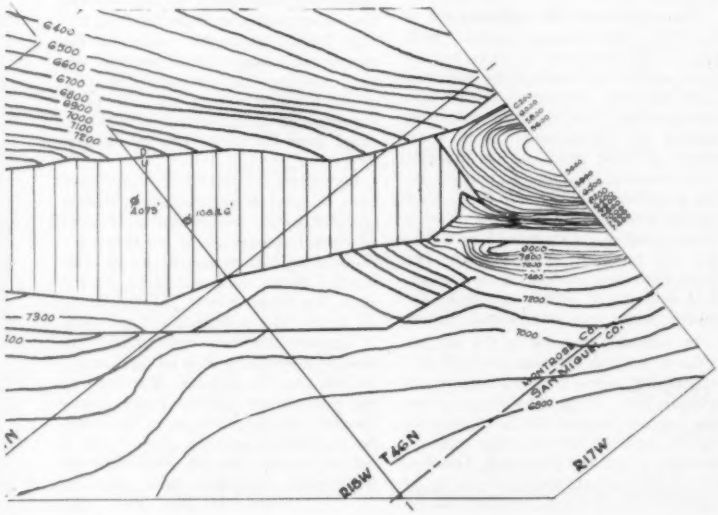


Fig. 2—Paradox anticline. Reconnaissance contours on top of Dakota show only approximate elevations and form. Contour interval: 100 ft. crosshatched area extruded Paradox, or presumably under shallow overburden.

Control at depth.—The author believes from the evidence now available that the controlling structure of the symmetrical salt anticlines, such as Paradox and Sinbad, below the salt, will prove to be anticlinal. In

(*Continued on page 130*)

FLUID

. . . A Source for

Pilot Plant — Here are results of 50-bbl.-daily operation

by R. M. Shepardson,* C. W. Tyson,* and A. Voorhies, Jr.†

THE real need for improved naphtha-reforming processes is just beginning to be felt. This need was effectively postponed for more than 10 years by the widespread installation of catalytic cracking processes which contributed substantially to raising the antiknock level of marketed motor gasolines. However, to keep pace with the continued increase in octane levels, the virgin naphtha components must now be upgraded more selectively and to higher levels than heretofore.

Catalytic reforming, which uses the fluidized solids technique, is one of the new selective processes announced in the past year. Known as fluid hydroforming, it is primarily a process development. Fluid hydroforming potentialities are believed to be as great as fluid cracking, and several commercial installations are now being made or designed for operation with a cheap nonprecious metal catalyst.

In most respects the fluid hydroforming plant is quite similar to a fluid cracking unit. The main difference between the two processes is in the operating pressure and the use of recycle gas. The catalysts are, of course, different in composition, but are similar in particle size. The fluid hydroformer, however, is a considerably more compact plant because of the higher pressure level and the lower carbon yield.

In other respects fluid hydroforming resembles the commercially proved fixed-bed hydroforming process. Many of the process conditions used in fluid hydroforming are essentially the same as are used in its fixed-bed counterpart, and the catalyst used is similar. It is thus pertinent that 8 commercial fixed-bed hydroformers have operated satisfactorily in the past 10 years. However, the application of the fluid solids technique has markedly improved the fixed-bed process from the standpoint of both product distribution and cost.

Efficient contacting, effective heat transfer, and steady-state operations are characteristics inherent in a fluid system. In hydroforming, these characteristics make possible a continuous regenerative process, with reaction and regeneration both being isothermal. Operations under conditions of higher carbon yield are entirely feasible, regardless of whether the carbon results from operating at high reforming levels or with poor feed stocks. In addition, continuous replacement of catalyst results in a steady-state operations which simplify both operating and maintenance practices.

Isothermal Reaction

The most important single feature of the fluid hydroforming process, however, is the isothermal reaction, for this is responsible for much of the improved yield structure. Extensive studies have demonstrated that catalytic reforming carried out isothermally gives a far higher gasoline yield. As an example, isothermal hydroforming of a heavy virgin naphtha to a 90 C.F.R.-R. clear octane level yielded 90.0 per cent of liquid product, as compared with 84.5 per cent for adiabatic operations. This yield difference reflects the severe thermal degradation which occurs in the leading sections of an adiabatic reactor.

In adiabatic operations the temperature of the inlet sections of the bed is appreciably higher than the average bed temperature. High inlet temperatures are needed because the heat absorbed by the endothermic reaction must be brought in entirely as preheat. This heat of reaction in hydroforming is large. An approach to isothermal reaction can be, and is made, in commercial nonfluid operations by the use of several reactors in series with reheat between reactors.

As the octane number is raised from the 85 C.F.R.-R. level to the 95 to 100 C.F.R.-R. range, the adaption of the multi-reactor system to a quasi-isothermal operation becomes progressively more complicated and costly. This is not the case with the single fluid-bed reactor system. Fundamentally these are the factors which make fluid hydroforming at 95 to 100 C.F.R.-R. levels as attractive as in the more conventional 80 to 90 C.F.R.-R. range.

In short, the adaptation of the fluid solids technique to hydroforming has given the fluid hydroforming process five distinctive features:

1. Single reactor isothermal operation.
2. Selective reforming at high as well as at conventional octane levels.
3. Regenerative reforming with low-cost catalysts not easily or acutely affected by operating upsets.
4. Flexibility in handling a variety of stocks at various reforming levels.
5. Low investment and operating costs.

Large-Scale Pilot Plant

A large-scale pilot plant has been operated for more than a year by the Esso laboratories at Baton Rouge, La. This fluid hydroformer resembles the commercial designs in all essential details. Designed for a nominal feed rate of 50 bbl. per stream day, the plant has operated at throughput rates which range from 30 to 90 bbl. per stream day.

Operations of the pilot plant have been directed at demonstrating process operability, at confirming small-scale pilot-plant results, and at obtaining the engineering data needed to design commercial plants. The operability of the plant has been entirely satisfactory at all times. Good fluidization of solids is actually obtained more readily in fluid hydroforming than in fluid cracking because the physical properties of the gases being handled under hydroforming conditions are more favorable. As a corollary, catalyst particle size is not as critical. In the pilot plant no fluidization difficulties have been ex-

(*Continued on page 140*)

*Esso Laboratories, Standard Oil Development Co., Linden, N. J. †Esso Laboratories, Esso Standard Oil Co., Baton Rouge, La.

HYDROFORMING . . .

the Motor Fuel of Tomorrow

Full-Scale Unit — First to use the fluidized catalyst technique

by James E. Seebold,* J. W. Bertetti,† J. F. Snuggs,‡ and J. A. Bock‡

THE first commercial hydroforming unit to use the fluidized catalyst technique will be put into operation this year at the Destrehan, La., refinery of Pan-Am Southern Corp. The unit is designed to process Gulf Coast naphtha for the production of high-octane aviation or motor-gasoline blending stocks.

Oil Flow

General process flow for the Destrehan unit is shown in Fig. 1. Naphtha feed and recycle gas will be preheated first by exchange against hot reactor effluent and then in furnaces. Preheated feed, recycle gas, and regenerated fluid catalyst will enter the reactor near its base. Vapor will flow upward through the fluidized catalyst bed, through a catalyst-disengaging space, and then through two stages of cyclone separators. After having passed through the recycle-gas and naphtha-preheat exchangers, the reactor effluent will enter the fractionator near its base.

The hydroformate, cut to the desired end point, will be taken overhead from the tower; and higher-boiling polymer will be removed from the bottom. Catalyst slurry withdrawn from the bottom of the fractionator will be returned to the reactor.

Gas and hydroformate taken overhead from the fractionator will be cooled, partly condensed, and passed into the reflux drum. Part of the gas from the reflux drum will be taken to the gas compressor to be recycled to the reactor; the remainder will flow to an absorber (not shown), where the butanes will be recovered. The liquid from the reflux drum will be charged to the stabilizer to produce a debutanized product. Design process conditions are shown in Table 1.

* Standard Oil Co. (Indiana), Chicago.
† Pan-Am Southern Corp., New Orleans.
‡ Standard Oil Co. (Indiana), Whiting, Ind.
Presented at A.P.I. midyear meeting, San Francisco, May 1952.

TABLE 1—Design Process Conditions

Reaction Conditions	
Hydroforming temperature, °F.	930
Naphtha preheat, °F.	940
Recycle-gas preheat (maximum), °F.	1,300
Pressure, psig.	250
Space velocity, pounds of naphtha per hour per pound of catalyst in reactor	0.45
Catalyst-to-oil ratio, pounds of catalyst circulated per pound of naphtha	0.35
Recycle-gas rate, standard cubic feet per barrel of naphtha	6,000
Recycle-gas hydrogen content, mol per cent	60
Regeneration Conditions	
Temperature, °F.	1,100
Pressure, psig.	260

Catalyst

Flow . . . Regenerated catalyst will flow continuously into reactor, where turbulent mixing with hydrocarbon vapors results in efficient contacting and uniform temperature conditions. Spent catalysts will be lifted by recycle gas through a riser into a hopper located above the reactor. Here the spent catalyst will be stripped with steam or recycle gas.

Spent catalyst from the hopper will flow through a standpipe into the regenerator. Regenerated catalyst will flow from the base of the regenerator through a standpipe into the reactor, completing its circuit.

Regeneration . . . The catalyst will be regenerated by continuous combustion of the small amount of catalyst deposit. Compressed air will enter the regenerator at its base. Surplus heat will be removed through vertical water tubes mounted inside the regenerator and partly submerged in the fluid bed of catalyst. Steam will be generated at approximately regenerator pressure so as to minimize leakage.

Flue gas which leaves the top level of the fluidized bed will pass through a disengaging space in the regenerator, and then through ceramic filters to remove any entrained catalyst. Operation of the ceramic filters will be rotated so that three units will be on stream while a fourth is being blown back with hot air. The flue gas will pass through a pressure-control valve

(Continued on page 139)

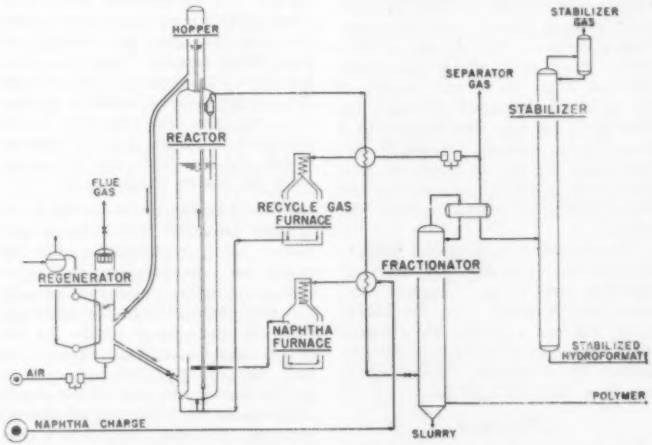


Fig. 1—Flow scheme of fluid hydroformer at Destrehan, La., refinery of Pan-Am Southern Corp.

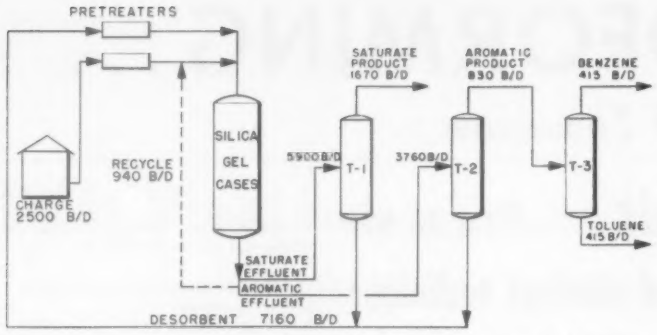


Fig. 1—Flow layout of typical Arosorber operation, using desorbent heavier than charge.

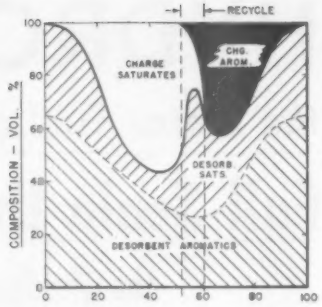


Fig. 2—Composition diagram of Arosorber effluent.

The Arosorb Process . . . *a new refining tool*

An Arosorber is a highly flexible unit capable of handling a wide variety of refinery streams of virtually any boiling range from about 150° to 700° F. Plant investments run from around $750,000 to $2,250,000, respectively, for nominal throughputs of 500 to 5,000 bbl. per day.

by W. H. Davis,* J. L. Harper,† and E. R. Weatherly†

THE Arosorb process is an outgrowth of the successful use of silica-gel adsorption as an analytical method for separating organic compounds. The analytical method was developed extensively in connection with A.P.I. Research Project 6, and since then has proved to be a highly useful procedure in most petroleum laboratories.

In the analytical method the gel is discarded after each test, as the relatively low cost of the gel does not warrant regeneration. However, in commercial application of silica gel for selective adsorption, discarding the gel or regenerating with heat to drive out the contained hydrocarbon or organic liquid would be prohibitively expensive. In 1943 an idea was developed by Sun research chemists for operating a silica-gel bed in a cyclic manner. First the bed is used for adsorption, and then is desorbed with a suitable liquid, leaving the gel in condition for reuse in the next cycle. This basic idea has resulted in the Arosorb process.

Although the process has been primarily developed for separation of aromatics from various refinery streams, it can be applied to the separation of other materials such as olefins, nonhydrocarbon organic liquids, or any separation where silica gel has a selective-adsorption affinity for one or more of the component liquids in the system.

The silica gel used is manufactured commercially by Davison Chemical Corp., and consists of granular particles ranging from 28 to 200 mesh. This material is used in one or more cases, or gel beds, which have diameters of 3 to 10 ft. and heights of 15 to 25 ft. Inasmuch as the cycle time for a gel case runs from 1 to 2 hours, it is advisable to operate several cases suitably staggered in flow pattern in order to smooth out the over-all flow of liquids through the system.

The desorbent used in any particular operation is chosen from the same chemical type as the material being selectively adsorbed from the charge stock, but has a sufficiently different boiling point to permit subsequent separation by distillation. This leads to two basic types of operation.

Operation

Low-boiling stocks . . . The scheme used for relatively low-boiling charge stocks consists of employing a desorbent higher boiling than the charge. This type of operation is shown in Fig. 1, which is a much simplified flow sheet of a unit charging 2,500 bbl. per day of catalytic reformate for the production of nitration-grade benzene and toluene.

The charge stock is pretreated by passing it over activated alumina or other suitable material for the removal of water and other gel poisons, and then passes into one of several silica-gel cases for a period of 30 minutes. The charge is then diverted to another case, and the first case is fed with desorbent for a period of 70 minutes, at the end of which time the gel is ready to receive charge again.

In the following discussion the terms "charge saturates" and "charge aromatics" refer, respectively, to the saturates, i.e., the paraffins and naphthenes, originally present in the charge and the corresponding aromatics originally in the charge stock. As the charge stock passes down through the bed, the charge aromatics are adsorbed, leaving the bulk of the charge saturates in the voids around the gel particles. The desorbent, which consists of a crude xylene stream containing about 65 per cent xylenes, pushes

*Process engineer, Sun Oil Co., Philadelphia, and †process development engineer, Sun Oil Co., Marcus Hook, Pa. Presented at A.P.I. midyear meeting, San Francisco, May 1952.

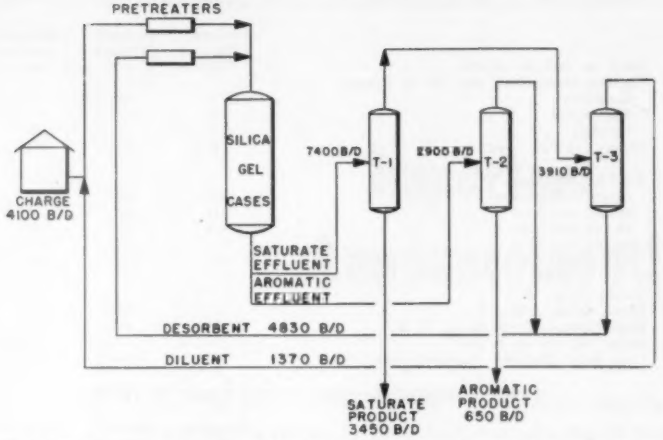


Fig. 3—Flow arrangement of typical Arosorber operation, using diluent and desorbent lighter than charge.

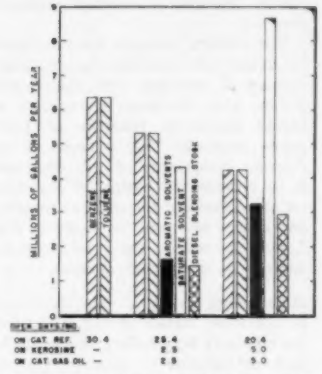


Fig. 4—Diversified operations for Arosorber II.

the saturates out of the silica-gel bed and displaces the charge aromatics adsorbed on the gel.

The effluent from the bed is divided three ways. The effluent containing the charge saturate goes to a tower, T-1, for recovery of the saturate product overhead and desorbent as bottoms, the latter being returned to the system for reuse. The next portion of the effluent may be recycled to the charge stream if particularly high-purity products are desired, as discussed in more detail later. The final portion of the effluent containing the charge aromatics flows to a fractionator, T-2, for recovery of the aromatic product as overhead and the desorbent again as bottoms. The fractionator, T-3, shown in the flow sheet is simply a benzene-toluene splitter.

Fig. 2 is a composition diagram of the effluent from a gel case during one complete cycle. Although the over-all desorbent stream contains 65 per cent xylenes and 35 per cent saturates of about the same boiling range as the xylenes, the composition of the desorbent in the effluent varies substantially during the cycle. Note that, at the beginning of the cycle, the effluent consists wholly of desorbent which is of normal composition.

As the cycle progresses, the charge saturates become a major portion of the effluent and the desorbent part is mainly aromatics. Later in the cycle the charge saturates disappear as the charge aromatics begin to show up in the effluent. During this period the desorbent saturates are present in a higher proportion than normal, relative to the desorbent aromatics. At the end of the cycle the effluent again is

TABLE 1—CATALYTIC REFORMATE—CHARGE AND PRODUCT TESTS

	Arosorber charge	Benzene	Toluene	Saturate product
Yield, per cent by volume	100.0	16.5	16.5	67.0
Chemical composition, per cent by volume:				
Aromatics	35	99	99	3
Olefins	2	...	...	3
Paraffins	56	...	...	84
Naphthenes	7	...	...	10
Specific gravity, 60°/60° F.	0.7580	0.8830	0.8707	0.6995
Solidifying point, °C.	...	5.10	...	...
Paraffins, per cent by volume	...	...	0.8	...
	D-86-46	D-850	D-850	D-86-46
A.S.T.M. distillation:	(°F.)	(°C.)	(°C.)	(°F.)
Initial boiling point	156	79.4	110.0	150
50 per cent point	186	80.0	110.7	185
Dry point	220	80.3	111.0	220
Acid-wash color	...	*4	*6	...
Bromine index	...	*227	...	...
Acidity	...	No free acid	No free acid	...
Sulfur compounds	...	Negative	Negative	...
Copper-strip corrosion	...	Negative	Negative	...
F-1 octane number†	75.7	...	...	62

*Before finishing. †Without TEL addition.

TABLE 2—200° TO 300° F. CATALYTIC GASOLINE FRACTION—CHARGE AND PRODUCT TESTS

	Arosorber charge	Aromatic product	Saturate product
Yield, per cent by volume	100.0	36.2	63.8
Chemical composition, per cent by volume.			
Aromatics	35	92	2
Olefins	6	1	8
Naphthenes	30	4	46
Paraffins	29	3	44
Gravity, °A.P.I. at 60° F.	47.0	32.7	55.7
A.S.T.M. distillation, °F.:			
Initial boiling point	208	232	215
10 per cent point	224	251	232
50 per cent point	242	266	244
90 per cent point	276	288	272
End point	320	364	304
Aniline point, °F.	67.1	...	128.3
Mixed aniline point, °F.	116.2	55.7	...
Kauri butanol solvent, ml. at 77° F.	55.4	90.0	36.9
Sulfur, per cent by weight	0.014	0.016	0.010
Octane No.:			
F-1, without TEL addition	83.9	...	63.1
F-1 plus 1 ml. TEL per gal.	...	...	74.0
Performance No.:			
F-3 plus 4.6 ml. TEL per gal.	...	109	...
F-4 plus 4.6 ml. TEL per gal.	...	195	...

wholly desorbent of normal composition.

The effluent between the two vertical dashed lines contains the only overlapping of saturates and charge aromatics, and this may be recycled to obtain maximum recovery of high-purity aromatics. The purpose of the saturate component of the desorbent is to provide the wedge of desorbent saturated between the charge aromatics and charge saturates, as shown in Fig. 2, and to reduce the total aromatic content of the recycle stream.

High-boiling stocks . . . The other type of operation, shown in Fig. 3, is used for relatively high-boiling charge stocks such as kerosine or catalytic gas oil. In this instance a 35:65 pentane-toluene mixture, which boils below the charge, is used as the desorbent. In addition, pentane is employed to reduce the viscosity of the charge. Choice of pentane here is merely a matter of convenience in describing the process; any low-boiling saturate fraction is suitable.

The flow sheet in Fig. 3 represents the same plant discussed in connection with Fig. 1, but is now shown operating on a typical charge stock in the kerosine boiling range. The kerosine plus the pentane diluent is pretreated, and flows to one of the gel cases for a period of about 80 minutes. This is followed by the desorbent for another 70 minutes to complete the cycle. The saturate and aromatic effluents again flow to fractionators T-1 and T-2, respectively, but now the toluene desorbent and the pentane diluent are taken as overhead streams, leaving the saturate and aromatic products as bottoms. The pentane-toluene overhead from T-1 is fed to T-3, which was the benzene-toluene splitter in the other operation, in order to recover the pentane diluent for reuse. This separation is not required on the overhead from T-2 because pentane is a component of the desorbent.

The effluent diagram for this operation would be similar to Fig. 2, the pentane diluent appearing partly in the charge saturates and partly as desorbent saturates. Recycle could be employed if desired, but extremely high-purity products normally are not required in kerosine and gas-oil operations.

Character of Products

Thus far the highlights of two general methods of operating the Arosorb process have been presented. The next step is to see what results can be obtained with the use of the highly flexible Arosorb process in a wide variety of stocks. The characteristics of the products which can be produced from various refinery streams are covered in the following discussion and accompanying tables.

TABLE 3—300° TO 400° F. NAPHTHA FRACTION—CHARGE AND PRODUCT TESTS

	Arosorber charge	Aromatic product	Saturate product
Yield, per cent by volume	100.0	15.8	84.2
Chemical composition, per cent by volume:			
Aromatics	17	91	1
Naphthenes	26	3	31
Paraffins	57	6	68
Gravity, °A.P.I. at 60° F.	47.4	31.1	51.1
A.S.T.M. distillation, °F.:			
Initial boiling point	298	306	295
10 per cent point	318	322	316
50 per cent point	334	336	337
90 per cent point	354	356	356
End point	400	400	406
Aniline point, °F.	127.0		150.4
Mixed aniline point, °F.	140.7	75.2	
Kauri butanol solvent, ml. at 77° F.	38.3	88.6	32.4
Sulfur, per cent by weight	0.019	0.028	0.010
Flash point (Tagliabue closed-cup tester), °F.	102	104	103

TABLE 4—KEROSINE—CHARGE AND PRODUCT TESTS

	Arosorber charge	Aromatic product	Saturate product
Yield, per cent by volume	100.0	15.8	84.2
Chemical composition, per cent by weight:			
Aromatics	16	91	1
Naphthenes	23	2	27
Paraffins	61	7	72
Bromine No.	0.4	1.5	0.0
Gravity, °A.P.I. at 60° F.	43.3	24.4	47.0
A.S.T.M. distillation, °F.:			
Initial boiling point	338	340	335
10 per cent point	370	374	368
50 per cent point	410	414	408
90 per cent point	458	465	455
End point	508	510	486
Aniline point, °F.	143.4		164.7
Mixed aniline point, °F.	147.6	75.2	
Kauri butanol solvent, ml. at 77° F.	36.1	98.2	28.2
Sulfur, per cent by weight	0.015	0.075	0.010
Flash point (Tagliabue closed-cup tester), °F.	125	126	124

TABLE 5—CATALYTIC GAS OIL—CHARGE AND PRODUCT TESTS

	Arosorber charge	Aromatic product	Saturate product
Yield, per cent by volume	100.0	35.4	64.6
Chemical composition, per cent by weight:			
Aromatics plus olefins	39	92	5
Naphthenes	17	3	26
Paraffins	44	5	69
Bromine No.	6.0	16.3	0.5
Gravity, °A.P.I. at 60° F.	29.3	11.1	41.2
A.S.T.M. distillation, °F.:			
Initial boiling point	422	425	420
10 per cent point	484	486	483
50 per cent point	511	515	508
90 per cent point	562	575	559
End point	604	625	604
Aniline point, °F.	131.8		181.8
Mixed aniline point, °F.	138.2	72.7	
D.D.T. solvency, per cent by weight		42	
Diesel index	39		75
Cetane No.	40		68
Pour point, °F.	+5	−25	+20
Sulfur, per cent by weight	0.16	0.26	0.10
N.P.A. color	1¾	4	1¼
Flash point (Pensky-Martens closed-cup tester), °F.	225	227	225
Saybolt Universal viscosity at 100° F., sec.	36.4	36.2	36.5

Benzene and toluene . . . Table 1 shows the nitration grades of benzene and toluene and the saturate product produced from processing a suitable cut from catalytic reformate. The charge to the Arosorber contains 35 per cent of aromatics, consisting of equal amounts of benzene and toluene. The

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benzene and toluene products shown in Table 1 represent material recovered directly from the Arosorber without any finishing step. The two products meet nitration-grade specifications except for the acid-wash color. The acid-wash color of the benzene is reduced to less than one and the bromine index to about four, by a comparatively light acid treatment. The toluene responds to treatment with equal ease. Incidentally, the Arosorb process rejects the bulk of any olefins present in the feed to the saturate product.

The saturate product is a light gasoline with an F-1 unleaded octane number of 62, but it also holds considerable promise as a very light paraffinic solvent.

Catalytic gasoline . . . Table 2 gives information for processing a 200° to 300° F. catalytic gasoline fraction. The aromatic product containing 92 per cent aromatics commands interest as a medium-drying aromatic solvent because of the 90 Kauri butanol solvency. This material also has a F-4 performance number of 195, upon the addition of 4.6 ml. TEL per gallon, therefore, is a valuable rich-mixture aviation-gasoline blending agent. The saturate product is considerably degraded in octane number from the charge because of the removal of aromatics, but still has an F-1 rating of 74 upon the addition of 1 ml. TEL per gallon.

300° to 400° F. Naphtha . . . Table 3 gives results from the treating of a 300° ot 400° F. straightrun naphtha fraction. The 88 Kauri butanol solvency of the aromatic product makes it an excellent high-solvency medium-drying solvent. The saturate product containing no olefins and only 1 per cent of aromatics is of considerable interest as a stock very closely approaching an odorless solvent of the medium to slow-drying type.

Kerosine . . . Table 4 gives the results of processing a typical kerosine; and the products are similar to those just discussed, except for the boiling point which throws them into the slow-drying solvent type.

Catalytic gas oil . . . Table 5 covers the operation on a typical catalytic gas oil, the highest-boiling product for which data are presented. Still higher-boiling products can be handled under somewhat different conditions.

The aromatic product from catalytic gas oil may be used as a very slow-drying solvent or as an insecticide solvent. The saturate product with a 68 cetane number has application as a high-cetane diesel-fuel blending agent.

TABLE 6—OPERATING COSTS FOR PROCESSING CATALYTIC REFORMATE

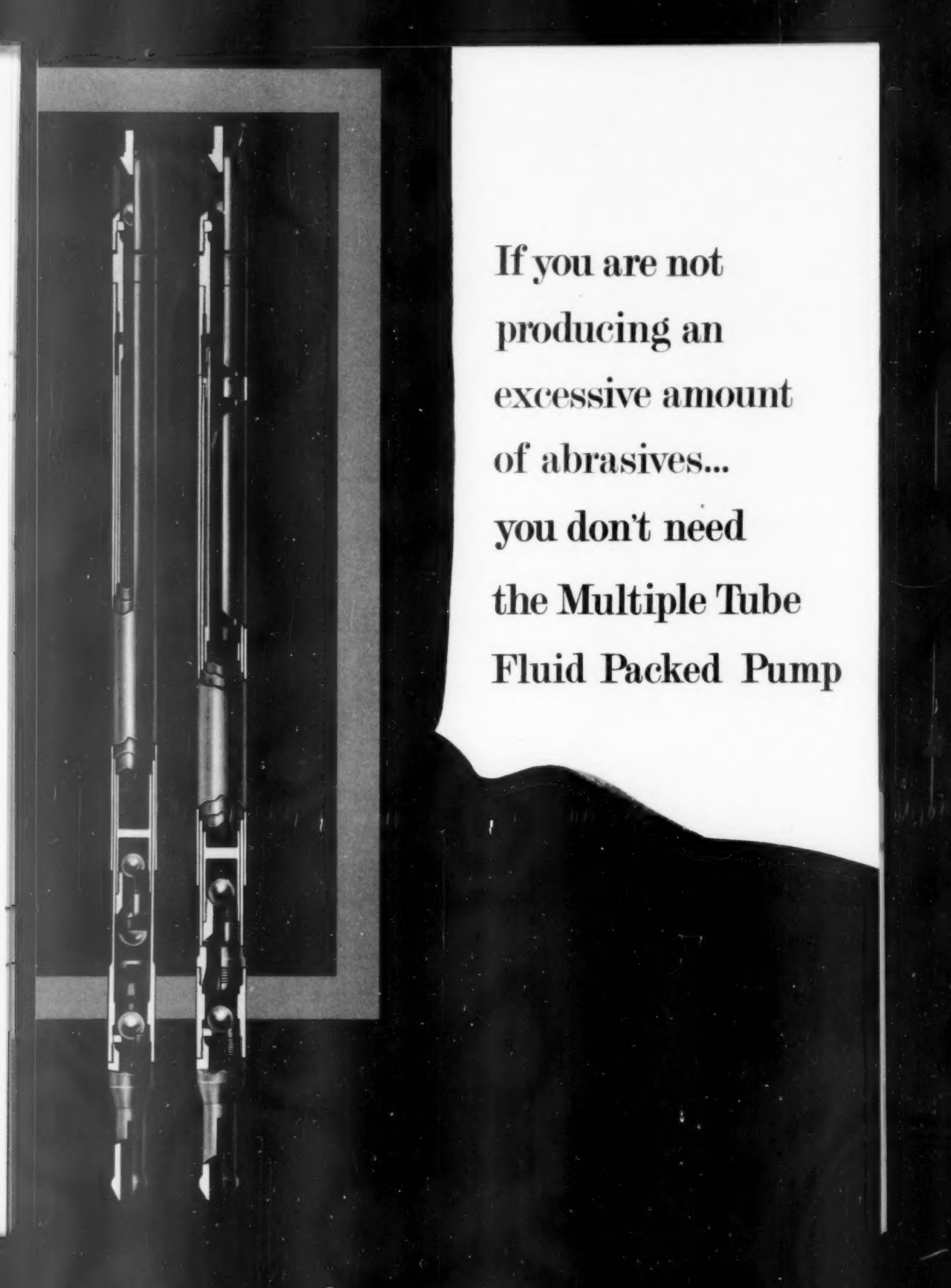
Arosorber unit—	I	II	III
Plant investment, millions of dollars	0.72	1.60	2.26
Throughput, barrels per day	500	2,500	5,000
Fixed charges, dollars per day:			
Depreciation, 10 years	197	438	619
Insurance and taxes, 0.5 per cent	10	22	31
Maintenance, 5 per cent	99	219	310
	306	679	960
Direct charges, dollars per day:			
Labor	120	120	120
Utilities:			
Power	7	35	70
Fuel	17	84	168
Steam	8	37	74
Water	9	44	88
Supplies:			
Xylene	2	10	20
Silica gel	32	161	322
Activated alumina	3	12	24
	198	503	886
Total operating cost	504	1,182	1,846
Dollars per barrel	1.01	0.47	0.37
Cents per gallon	2.35	1.12	0.88

TABLE 7—OPERATING COSTS FOR PROCESSING KEROSINE

Arosorber unit—	I	II	III
Plant investment, millions of dollars	0.72	1.6	2.26
Throughput, barrels per day	820	4,100	8,200
Fixed charges, dollars per day:			
Depreciation, 10 years	197	438	619
Insurance and taxes, 0.5 per cent	10	22	31
Maintenance, 5 per cent	99	219	310
	306	679	960
Direct charges, dollars per day:			
Labor	120	120	120
Utilities:			
Power	7	35	70
Fuel	18	88	176
Steam	8	41	82
Water	9	44	88
Supplies:			
Isopentane	3	15	30
Toluene	2	12	24
Silica gel	32	161	322
Activated alumina	3	12	24
	202	528	936
Total operating cost	508	1,207	1,896
Dollars per barrel	0.62	0.29	0.23
Cents per gallon	1.48	0.69	0.55

TABLE 8—OPERATING COSTS FOR PROCESSING CATALYTIC GAS OIL

Arosorber unit—	I	II	III
Plant investment, millions of dollars	0.72	1.60	2.26
Throughput, barrels per day	360	1,800	3,600
Fixed charges, dollars per day:			
Depreciation, 10 years	197	438	619
Insurance and taxes, 0.5 per cent	10	22	31
Maintenance, 5 per cent	99	219	310
	306	679	960
Direct charges, dollars per day:			
Labor	120	120	120
Utilities:			
Power	7	35	70
Fuel	15	75	150
Steam	9	45	90
Water	8	38	76
Supplies:			
Isopentane	5	24	48
Toluene	10	50	100
Silica gel	32	161	322
Activated alumina	3	12	24
	206	560	1,000
Total operating cost	512	1,239	1,960
Dollars per barrel	1.42	0.69	0.54
Cents per gallon	3.38	1.64	1.29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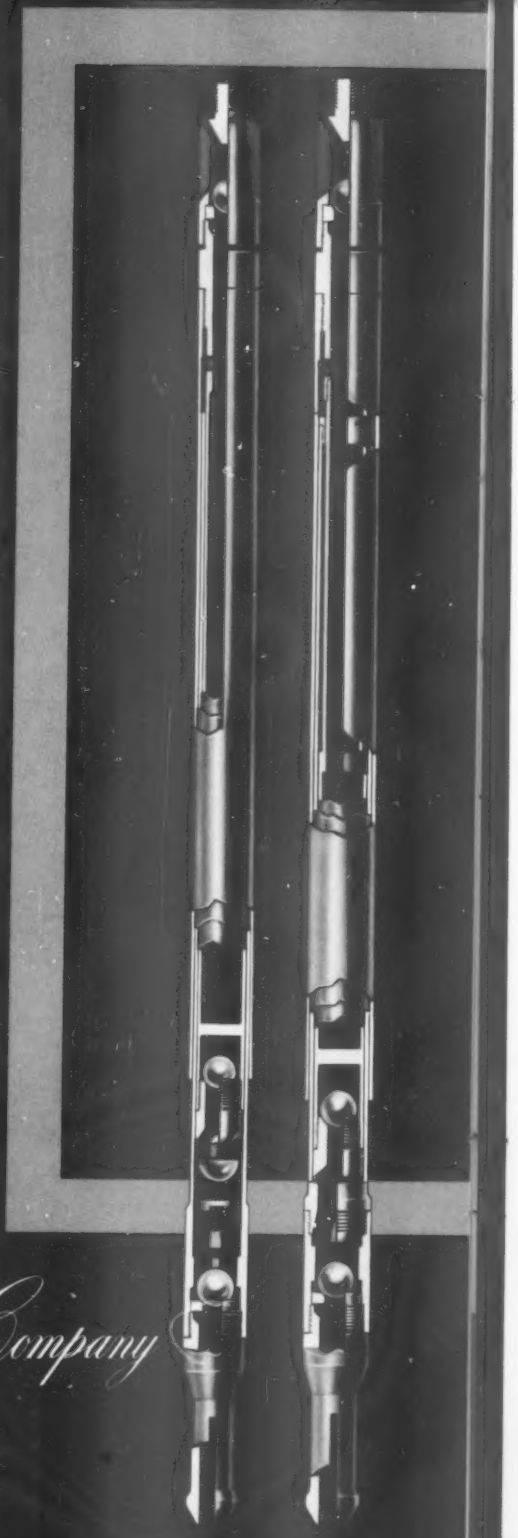

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Desulfurization . . . As shown in Tables 2 to 5, sulfur compounds tend to concentrate in the aromatic product, giving saturates with sulfur content much lower than those of the corresponding charge stocks. This point is of small importance with the low-sulfur materials used in this work, but may have real significance to the refiner who runs high-sulfur crudes.

Investment and Operating Costs

Estimated investment and operating costs for three different sizes of Arosorb units, designated I, II, III, are presented in the following text and in Tables 6 through 9. The operating costs for these three units are also shown for three typical operations, viz., charging catalytic reformate, kerosine, and catalytic gas oil.

The three units were designated basically for charging 500, 2,500, and 5,000 bbl. per day of catalytic reformate for the production of benzene and toluene. The throughputs were then calculated for the kerosine and catalytic gas-oil operations after the removal of only obvious, small bottlenecks. As a result, the investment costs represents completely flexible plants with the indicated capacities for the several typical operations.

The estimated plant investment ranges from $720,000 for the 500-bbl. per day charging capacity to $2,260,000 for the 5,000-bbl. per day unit. These investment figures are based on an erected plant within battery limits, including silica gel and activated alumina, as well as engineering and contractor's fees.

The units have a greater capacity for kerosine than catalytic reformate which results from the low aromatic content of the kerosine, and a comparatively low distillation load per barrel of charge. The high viscosity of the catalytic gas oil requires greater dilution and this, together with the higher aromatic content, reduces throughput.

Table 6 gives the operating costs for the three units processing the catalytic reformate stock. The operating costs—which include the fixed charges for 10-year depreciation, insurance, taxes, and maintenance—range from 2.3 cents per gallon of charge for the smallest plant to 0.9 cent for the largest plant. The unit costs for labor and utilities were based on approximate Gulf Coast figures, and the values used are given in Table 9 so as to permit converting processing costs to any other basis desired.

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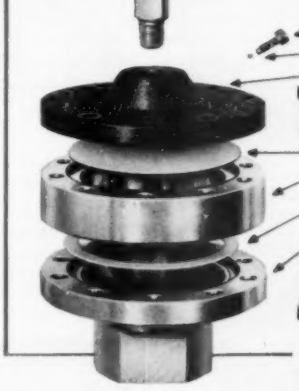

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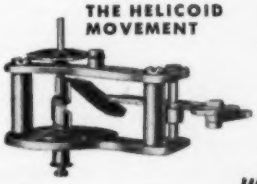

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TABLE 9—LABOR AND UTILITY COSTS, BASED ON GULF COAST

Labor—2 men per shift at $2.00 per hour.
Supervision—1 man for 1 shift per day at $3.00 per hour.
Power—$0.005 per kilowatt-hour.
Fuel—$0.12 per million B.t.u.'s (as gas).
Steam—$0.25 per 1,000 lb.
Water—$0.02 per 1,000 gal.

Table 7 covers similar information for charging kerosine. As indicated previously, the capacity of the units is appreciably increased, viz., about 60 per cent higher than for reformate; and, as a result, operating costs per gallon of charge are down to 1.5 to 0.6 cents, depending again on the size of the unit.

As shown in Table 8, the range of throughput for the catalytic gas-oil operation is 360 to 3,600 bbl. per day. The operating cost range is 3.4 to 1.3 cents per gallon of charge.

A running royalty figure was not included in the foregoing operating costs, as it is a small item. A basis for a paid-up royalty is provided for those refiners who prefer such an arrangement.

Diversified Operations

Particularly in the case of the larger Arosorb units operating continuously on either kerosine or catalytic gas oil might produce too large a quantity of products compared to demand. Furthermore, many refiners would wish to process a variety of stocks in order to have a diversified line of aromatic and saturate solvents, diesel oil, etc. Advantage may then be taken of the great flexibility of the Arosorb process, which permits the refiner to select the best combination of operations to suit the market situation at any particular time. Inasmuch as Arosorbers of the type described in this paper can handle almost any type of available refinery stream (from 150° to 700° F.), the number of operating combinations and the diversity of products are virtually unlimited. The problem then becomes only one of selecting the most profitable combination.

Fig. 4 was prepared merely as an example to illustrate diversification, using the three charge stocks for which operating cost figures were given earlier. In Fig. 4 the number of days per month for each of the three operations is given at the bottom, and the amount of each product produced is shown by the vertical bars. The chart was calculated for Arosorber II, the intermediate-size unit.

The situations developed by running kerosine and catalytic gas oil each for 2.5 or 5 days per month at the expense of catalytic reformate result in an interesting balance of products, ranging from benzene and the fastest drying aromatic and saturate solvents to the slowest drying solvents and diesel fuel. The saturate gasoline produced incidental to the manufacture of benzene and toluene was not included in Fig. 4 because gasoline quantities are not normally considered in terms of gallons per year. Expressed as barrels per month, the gasoline amounts to 51,000, 42,000, and 34,000, respectively, for three cases.

Of necessity, the studies outlined herein have been limited to three stocks. However, many refiners may have other streams, varying in boiling range and aromatic content, which they might wish to process. Universal Oil Products Co. and Houdry Process Corp. are agents authorized to license the Arosorb process under patent rights of the Sun Oil Co.

BOOKS

PERFORMANCE OF LUBRICATING OILS. By H. H. Zuidema. Published by Reinhold Publishing Corp., 330 West Forty-Second Street, New York. 179 pp. $5.

This book, amply supplied with helpful charts, tables, and illustrations, summarizes and evaluates the wealth of data on the performance characteristics of lubricating oils under various conditions. The subject is approached from the point of view of performance (oxidation, bearing corrosion, etc.) rather than specific application because performance characteristics are of a more basic nature than the properties of an oil for specific use.

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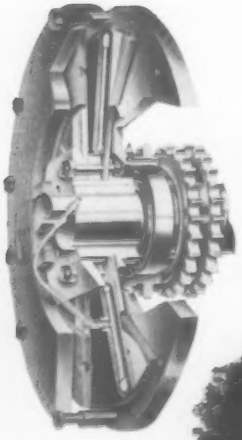

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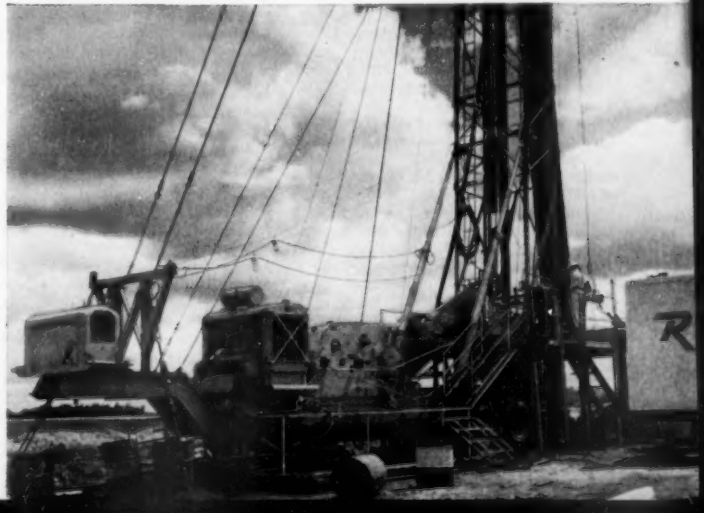

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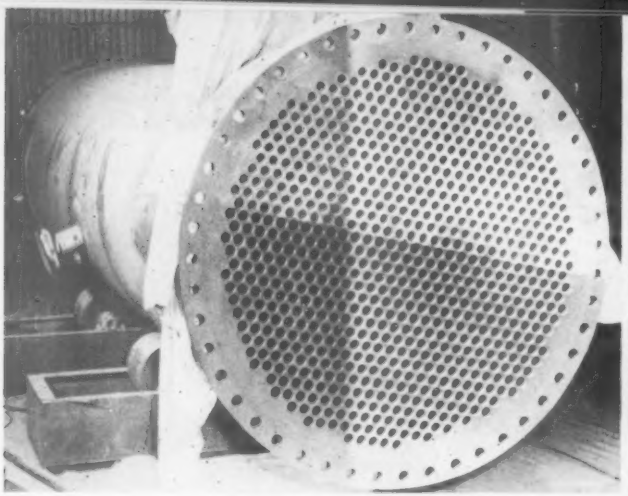
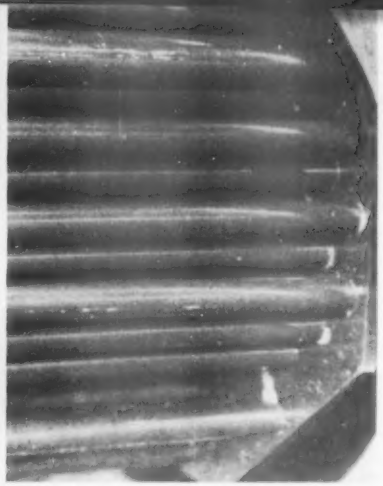


Tube sheets and tube surfaces of this exchanger unit have been plastic coated. External coating is applied to tubes prior to assembling.



View of a tube bundle showing coated exterior of tubes and tube sheet.

Plastic Coatings Aid Refiners In Fight Against Corrosion

by F. Lawrence Resen
Gulf Coast District Editor

Both interior and exterior surfaces of exchangers, valves, piping, tanks, and other equipment items may be protected.

PLASTIC-COATED equipment for corrosive service is finding increased use among refiners. One type being used is a baked phenolic formaldehyde coating which performs satisfactorily in various organic services at temperatures of 225° F. and with inorganic acids and salts in most instances.

Application of the coating involves cleaning and sandblasting the surface in question, then spraying on and baking successive coats. It has been effectively applied to plug valves, piping, heat-exchanger surfaces and tubing, flanges, fittings, tanks, and pumps by Plastic Applicators, Inc., Houston.

In addition to protecting new equipment from corrosive effects, the coating is also being applied to used equipment, where it performs well, provided the surfaces have not become extensively pitted in corrosive service.

Heat exchangers.—The plastic coating has been used successfully to avoid metal loss. Also it increases heat-transfer efficiency of heat exchanger tube bundles. Tubes may be coated both internally and externally.

Experience with heat transmission of the plastic has shown that for a bundle normally requiring cleaning every 3 months, heat transmission of the coated tubes will be better than uncoated tubes after approximately 10 days operation. This is due to the smooth surface to which fouling material will not cling.

Exterior plastic coatings help to cut down cleaning time since water can be used for cleaning the bundle, where previously chipping and scraping were necessary to clean the tubes. The coating prevents buildup of salt on treated surfaces.

Exterior coating is applied before the tube bundle is assembled, and the only precaution necessary to prevent damage to the coating during assembly is to deburr the baffles. Ends of the tubes, which enter the sheet, are uncoated. The tubes are thus coated singly and assembled.

For interior protection, tubes are rolled into the sheet prior to plastic coating. The smallest diameter tubes conveniently handled are ¾ in. 16 gage. Interior surface coating is made after assembly of the bundle, by use of an extended spray gun. Tube ends are reamed flush after rolling and the sharp edge of the tube end is rounded. The coated tubes have been used in various services including water side of condensers, product side of rich-oil coolers, and product side of acid coolers.

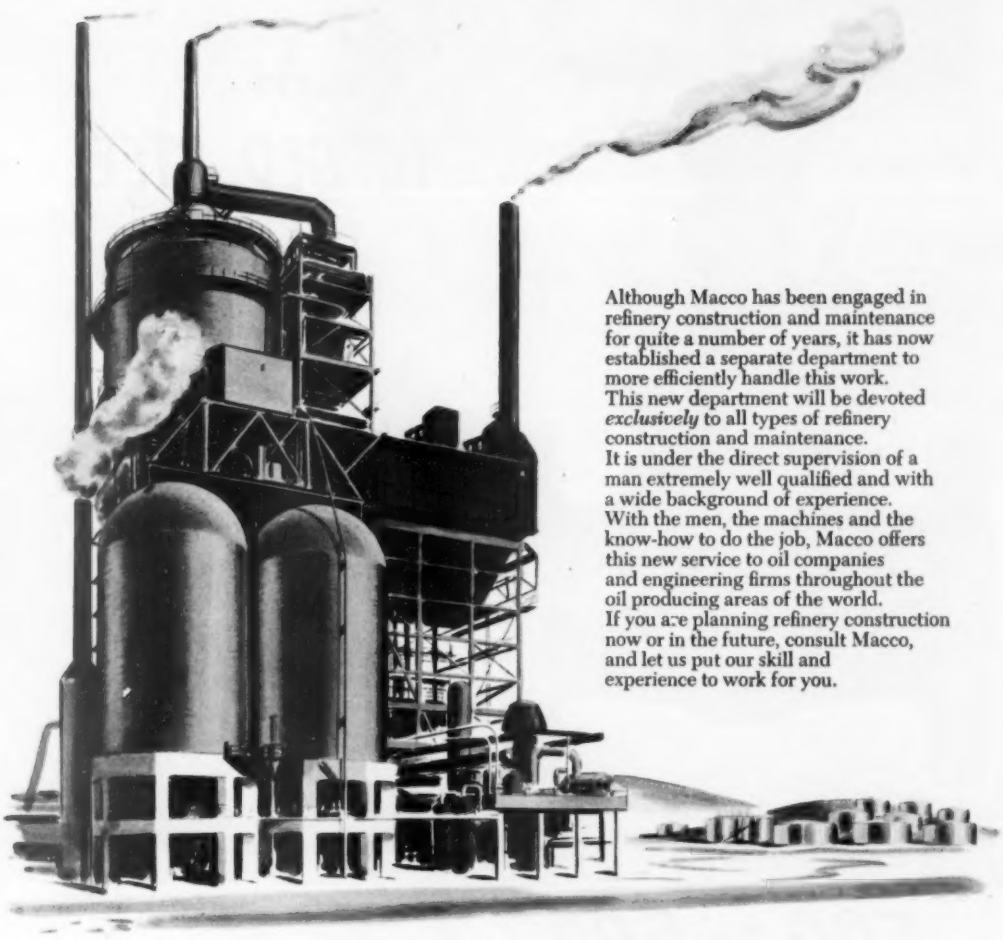
Plug valves.—Extensive use has been made of the plastic coating with plug-cock valves. Because of the close tolerances necessary to the valve's operation the plug has to be undercut to provide space for the plastic coating. All exposed surfaces are coated including the plug, inside of body and flange face, and through liquid passage. After the plastic has been baked to required hardness, the plug is lapped into the body, effecting a tight seal. The valve is then assembled and lubricated and ready for service.

The plastic has been performing satisfactorily in sulfuric acid service to overcome the freezing of plug cocks due to formation of ferric sulfate which cements the plug to the body of the valve. The plastic, unaffected by sulfuric acid in strengths less than 98 per cent, eliminates the formation of such a deposit.

Piping.—The plastic coating has been found especially useful in piping serving corrosive processes. Pipes fabricated in straight sections using seamless-steel tubing and slip-on flanges are recommended. A minimum of ¼-in. radius should be turned or ground on the pipe opening. Fitting should be fabricated as most castings are porous and honeycombed and it is sometimes impossible to obtain a good coating job due to surface imperfections.

General uses.—The coating is also suitable in protecting the interior of tanks which are used to handle corrosive materials. Here also welds must be ground smooth and made free of pinholes. All nozzles and openings have to be ground to a ¼-in. radius.

Ductwork which handles solids, moisture, and air can be coated internally to provide an adhesion resistant surface. The plastic coating has also proved beneficial in the protecting of



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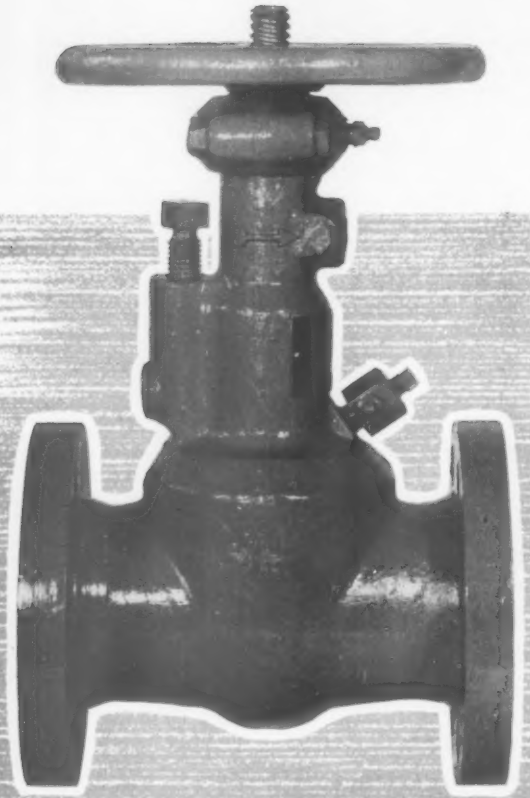

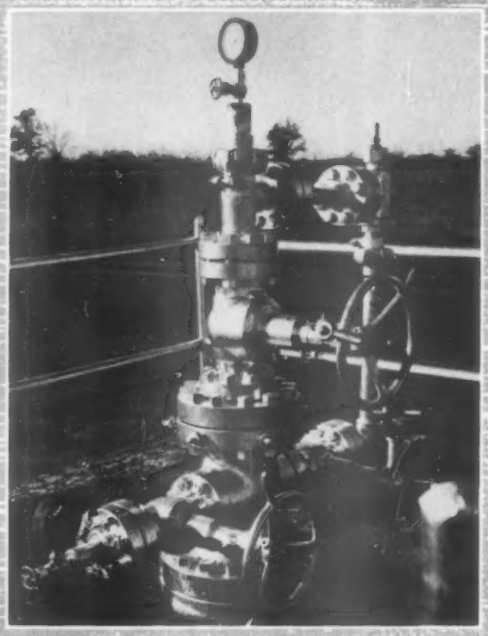

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equipment exteriors exposed to acid fumes or splash such as pump bases, bearing housing, packing glands, and case exteriors. Field service is provided when tanks are too large to be transported to the shop. Field applications are made with portable heating units and fireproof insulating blankets to attain necessary temperatures required in bake period.

Chemical resistance. — Under field conditions the coating has proved resistant to organic solvents and acids, to most inorganic acids and salts and to mixtures of organic and inorganic chemicals. It is not recommended for services in contact with solutions having pH greater than 9, with hydrofluoric acid, or sulfuric acid in higher concentrations than 98 per cent or with furfural.

Experience has shown that inorganic acid is less prone to attack the coating in the presence of hydrocarbons than when equivalent acid concentrations are in contact with the coating. Such a phenomenon can be illustrated by an instance where a 60 per cent sulfuric acid solution at 200° F. caused the plastic to oxidize and char within a year. With a 50 per cent volume of hydrocarbons, such as butadiene or light and heavy oil, the plastic has held up for more than 2 years at operating temperatures of 230°-245° F. without apparent damage.

Operating temperatures are recommended not to exceed 225° F. although the plastic may be used up to 245° F., provided test runs are made prior to using the coating in full service.

Typical applications.—The coating has been applied as a means of combating corrosion in refining and chemical equipment. It has been used in tanks, piping, and pumps in chlorinated aromatic hydrocarbons with traces of moisture present. It has been used on similar equipment with mixtures of organic alcohols and 65 per cent sulfuric acid, as well as in ductwork and blowers in hydrochloric and sulfuric acid fume service. Plug valves in sour-gasoline service or with naphtha or light hydrocarbons and hydrogen sulfide at temperatures up to 200° F. have been in operation with no appreciable wear after 4 years of service.

Service record.—In various refining installations the equipment has been undergoing periodic checks. The following is indicative of the service life of the plastic:

1. Fresh acid service in sulfuric acid alkylation plant in discharge line to recycle pump. Acid varies from 88 to 98 per cent. Valves are in service after 47 months.

2. Spent acid service in sulfuric acid alkylation plant in discharge line to manifold to pump. Valves still in service after 47 months.

3. Valve used in water drawoff line on West Texas naphtha tank and later in rerun bottoms line. Total service at inspection was 34 months. Condition of valve and plastic good.

4. Valves in sour gasoline line service. Inspected at end of 6 months, plastic found in good condition.

5. Rerun sour gasoline line to pump charging copper sweetening unit. Valves inspected after 34 months of operating time and found good.

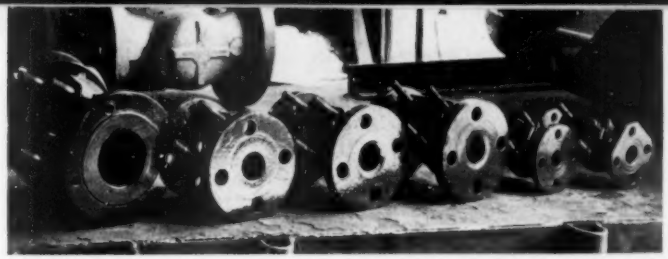
6. Water drawoff line service to light-oil agitators. Condition of plastic coating good at 20 months.

Plastic application.—Preparation of the surface for spraying on the plastic coat is the most important phase of its application. Sandblasting is recommended for welds to bring out pinholes which may be filled prior to coating. Welds are also ground carefully to remove knife edges. Castings with sand holes and other imperfections are brazed and ground in preparation for coating.

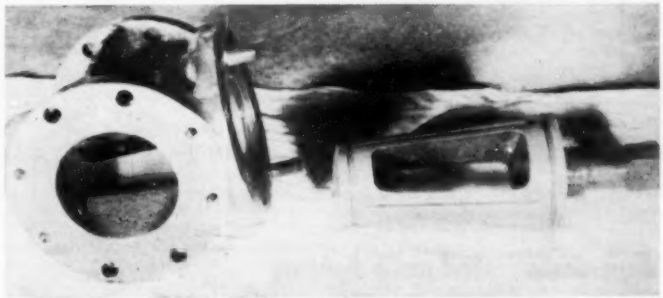
Equipment is prebaked as a step in removing any chemicals imbedded in the grains, which might boil out during the curing period. A final sandblasting is done to remove objectionable material clinging to the surface and to provide a suitable finish for bonding.

The plastic is sprayed on in multiple coats with intermediate baking to remove final traces of solvent and to harden it sufficiently for handling. Coating thickness of 0.004-0.005 in. provides a protective cover strong enough to resist erosion and yet not so thick as to become brittle. To provide a smoother coating and to remove irregularities the coated surface is sanded.

A final high-temperature bake is used to polymerize the coating making it insoluble in its original solvents. The coating service available by Plastic Applicators, Inc., provides for shop work where all parts are oven baked. A field service is also available for tanks where they are too cumbersome to transport to the shop.

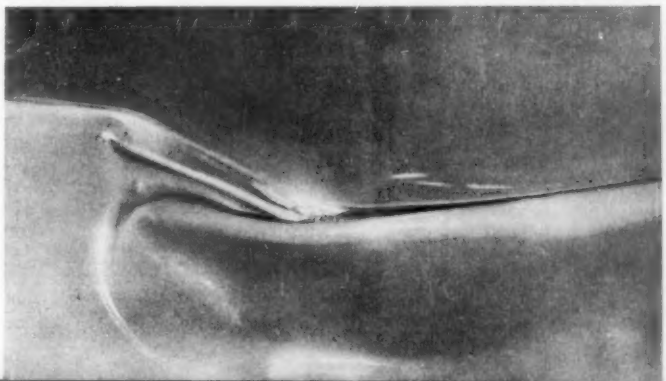


The glossy finish on these valve bodies occurs after the plastic coating has been baked.



After coating with phenol-formaldehyde resin, the plug is lapped into the valve body.

Toughness of the plastic protective film is illustrated by this view of a damaged tank.



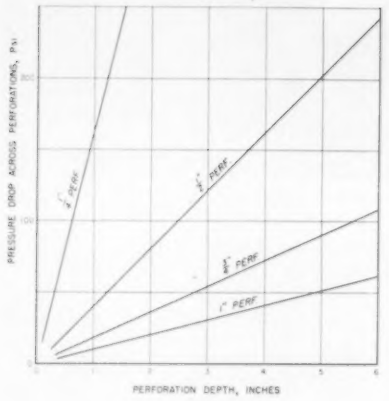
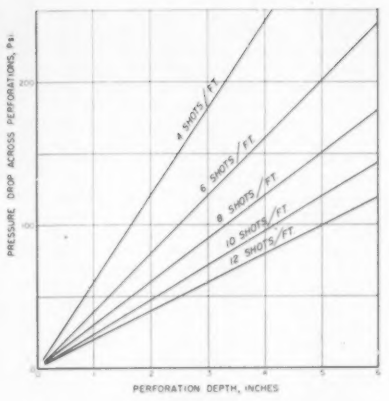


Fig. 1—(Left) Effect of perforation size on pressure drop across sand-filled perforations.

Fig. 2—(Right) Effect of perforation density on pressure drop across sand-filled perforations.



DATA

6 shots per ft. $Q = 20$ bbl. per day per ft.
$K = 10$ darcies $y = 2$ cp.

DATA

½-in. perforations $Q = 20$ bbl. per day per ft.
$K = 10$ darcies $y = 2$ cp.

Experiments shed more light on

Effect of Sand-Filled Perforations On Well Performance

The author concludes that whereas shot penetration is of more importance in perforating competent formations, greater hole size and density is more important when perforating unconsolidated formations.

by R. L. O'Shields*

SEVERAL oil-producing areas, particularly the Gulf Coast and California, are confronted with the problem of producing from unconsolidated sands which will plug the well bore if not excluded by some physical means. Several sand exclusion methods have been developed which satisfactorily screen loose sands.

In general, methods such as inside casing gravel packs and prepack gravel liners which screen the sand inside casing yield lower well productivities than those methods in which the sand is screened outside the casing. This article discusses the magnitude of pressure drops which exist across perforations when filled with unconsolidated sand.

The relative effects of perforations on well productivity have been reported in the literature by McDowell and Muskat[1] and Howard and Watson.[2] These investigations, conducted independently, measured the relative productivities through electrical model studies and obtained comparable results. Each study was based on clean, open perforations penetrating varying distances into the formation. This adequately represents the case of perforations penetrating competent formations.

Once flow is established in unconsolidated formations, however, sand flows into and fills the perforations unless screened at a point outside the casing. Sand-filled perforations act as a bottom-hole choke and reduce well productivity to a further degree than shown by the curves of the aforementioned investigators.

Pressure drops across sand-filled perforations have been calculated by use of Darcy's law and are shown in Figs. 1 and 2. Basic assumptions used are: **Sand Permeability**—10 darcies; **Flow Rate**—20 bbl. per day per foot of perforations; and **Fluid Viscosity**—2 cp. Perforation depth as used is the distance from the inner casing wall to the outer edge of the cement. This distance will vary in wells depending on the degree of hole enlargement in the unconsolidated formation during drilling operations.

Fig. 1 shows the effect of perforation size on the pressure drop at a perforation density of six shots per foot. For the assumed conditions, the pressure drop across ½-in. sand-filled perforations 3 in. deep is 121 psi. Fig. 2 shows the effect of perforation density on pressure drops across ½-in. sand-filled perforations. For example, the pressure drop for four shots per foot is 182 psi. as compared to the previous example. These particular cases are cited, as it is common practice of many operators to perforate with either four or six ½-in. shots per foot. It should be emphasized that the listed pressure drops exist across the perforations alone.

The pressure drops shown in Figs. 1 and 2 may be converted to any particular situation by multiplying listed values by the proper ratio of the basic parameters involved. For instance, if all factors in the cited examples above were the same as those used, except that sand permeability is 5 darcies, the pressure drops would be twice as large, or 242 and 364 psi. respectively.

No attempt is made in this study to show the exact effect of sand-filled perforations on well productivity. This could best be determined with an

*Southwest Producing Division, Pure Oil Co., Fort Worth.

electrical model wherein the thickness of casing and cement is represented. This investigation does show that large pressure drops which would lower productivity do exist across sand-filled perforations.

The adverse effect of sand-filled perforations was confirmed by radial flow tests conducted in the petroleum engineering laboratories of Louisiana State University. A large-scale radial-flow apparatus was equipped with 5-in. casing having eight ½-in. perforations, about 2 in. deep, over a 1-ft. interval. The sand reservoir was filled with consolidated sand produced from Leeville field, Louisiana, having a permeability of 6.9 darcies as packed. During flow tests, the sand was screened with 0.040-0.060-in. diameter gravel.

On the first test the sand was allowed to fill the perforations, and the resulting specific productivity index of the system measured 0.130 bbl. per day per lb. per sq. in. per ft. of sand. The perforations were next cleaned out and filled with gravel to prevent entry of the sand. Under these conditions, the specific productivity index amounted to 0.195 bbl. per day per lb. per sq. in. per ft. of sand, a fifty per cent increase over the first test. The difference can only be attributed to the material in the perforations, as all other factors were the same during each test.

The above tests were conducted in conjunction with research of a wider scope, and there was not sufficient time for extended research on this subject. As suggested previously, such research could be be performed with electrical models wherein changes in physical equipment are more readily made than with large-scale flow apparatus.

Sand-filled perforations are present with two commonly used sand control methods, prepack gravel liners and single-stage (inside casing) gravel packs. Whereas these methods give good results in open-hole completions, they usually result in low productivities in cased wells. In a recent paper, LeBlanc[2] compared productivities of single-stage gravel-packed wells and two-stage gravel-packed wells in Bay Marchand field located in the Gulf of Mexico. In two-stage packs, gravel is squeezed outside the casing on the first stage, and the second stage consists of packing gravel inside the casing. In this field, productivity indices of single-stage packs averaged only 0.350 bbl. per day per lb. sq. in. as compared to an average of 1.40 bbl. per day per lb. sq. in. for two-stage packs.

Similar poor performance of inside casing filters has been noted in several areas, and production men often attribute this phenomenon to a plugging action peculiar to inside packs. Of single-stage packs, LeBlanc[2] states: ". . . . One of the detrimental characteristics of a single-stage pack is that it will gradually plug up, thus reducing flowing tubing pressure and production in proportion . . ." In cases such as Bay Marchand field, it is felt that the lower productivities and so-called plugging of inside packs is due mainly to large pressure drops across sand-filled perforations rather than to the usual plugging agents.

The ideal solution to sand-filled perforations insofar as gravel pack methods are concerned is to complete in open hole with gravel packed directly against the formation. In many areas, however, other factors such as reservoir conditions or the presence of multipay zones necessitate casing off the pay. The two-stage gravel pack minimizes the pressure drop across sand-filled perforations by screening the sand outside the casing, thus preventing its accumulation within the perforations. It is the writer's belief that this is the outstanding reason for wells so packed yielding higher productivities than similar wells packed inside the casing only.

The effect of sand-filled perforations can also be minimized in cases where the single-stage or prepack gravel liner is employed. This is achieved by using larger perforations at a greater density than is usual in most well work. For the conditions of Fig. 1 and 2, the pressure drop across six ¾-in. perforations is 54 psi. and across six 1-in. perforations is 31 psi. at a 3-in. depth as compared to 121 psi. for six ½-in. perforations. At a density of 10 shots per foot, the

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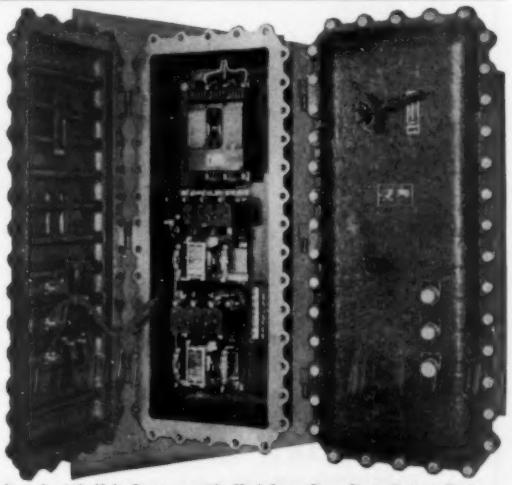

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pressure drops across ¾-in. perforations are 32 and 19 psi. respectively. It is believed that the performance of inside casing sand filters can approach that of the outside filters by increasing both perforation size and density. This practice would also enable the operator to obtain a more uniform placement of gravel about the casing when applying a two-stage gravel pack.

Conclusions

1. Sand-filled perforations introduce a large pressure drop at the well bore which restricts well productivity below the values shown in recent investigations.[1,2]

2. Experimental work conducted by the author and field performance of wells gravel packed both with the single-stage and two-stage methods substantiate this proposition.

3. Productivities of wells utilizing inside casing sand filters can be increased to approach that of outside filters by substantially increasing both perforation size and density above the usual four or six ½-in. shots per foot.

4. Whereas greater shot penetration is of more importance in perforating competent formations, greater hole size and density is more important when perforating unconsolidated formations.

Acknowledgments

The author wishes to express his sincere appreciation to the staff of the petroleum engineering department of Louisiana State University under whose guidance the reported research was conducted.

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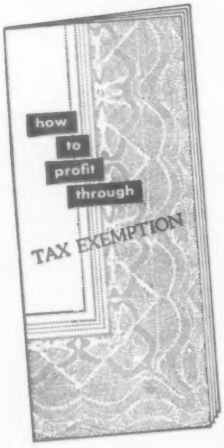

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INFORMATION IS THE FOUNDATION OF SOUND INVESTMENT

Oil and Gas in the Paradox Basin

(*Continued from page 109*)

the sinuous-type folds, such as Gypsum Valley and Salt Creek, the controlling structure at depth may be faulting. However, Salt Valley may not be as sinuous as it seems, as its present shape may be due to overlap and recent salt movement. For instance, Pure Oil Co.'s Salt Valley well is reported to have gone from Moenkopie into salt.

Potential Reservoir Rocks

The obvious and most practicable approach to the finding of oil in a wildcat area such as this is by analogy. No two oil provinces are exactly alike but many have common characteristics. Most basins which have salt are already producing oil in beds closely associated with the salt. An obvious regional comparison with the Paradox basin is the West Texas-New Mexico Permian salt basin and the Pennsylvanian black shale basin in West Texas.

Mesozoics.—Most of the Cretaceous has been eroded and hence is not expected to be of importance as a producer of oil and gas. Small amounts of oil have been produced from sandy zones in the lower Mancos at Cresent Junction.

Jurassic and Triassic rocks are so frequently exposed that they, too, are not expected to produce very much oil or gas. The uppermost Jurassic is producing some gas at Ignacio. The Entrada has shown dead oil in Pure's Horsefly well and has had shows on its outcrop and in shallow wells east of Durango. It is about the same age as the Sundance in Wyoming, and could become an important producer in the Four Corners area. The areas where it lies at favorable elevations in respect to its outcrop in the Paradox basin are limited and is not likely to be actively explored in the near future. The Moenkopié could produce under favorable conditions but no shows have been reported from it within this area, except those in General Petroleum Corp.'s San Rafael

well. The remainder of the Juro-Triassic is fluviatile or windblown and is not believed to be attractive.

Permian rocks.—The Coconino and Kaibab of the Permian have shown saturation in wells west of the Green River, but are cut by that river at a low elevation and failed to produce. There are a few shallow oil wells in beds attributed to the Coconino at Boundary Butte. Neither of these formations has been recognized in the Colorado portion of the basin and if present will probably be found in the synclines between the salt anticlines. If present here, they could produce. Their future at this time does not look very bright, although the possibility of substantial production from them eventually should not at this time be written off.

No shows have been reported from the Cutler. It is entirely fluviatile and windblown and with the exception of where it may be present in small folds where it is cut downdip by the salt intrusions probably will not produce. Where it is cut by the salt with closure updip from the salt, it may produce gas in porous zones. There are a number of gas seeps from the Cutler in the Dolores River where it cuts the small truncated anticline previously described, which is an indication that it may produce gas commercially at this place.

Rico formation. — Without taking part in the argument as to the Permian or Pennsylvanian age of the Rico, it is considered a part of the Pennsylvanian for the purpose of this discussion. In all proven areas most productive horizons have shows over large portions of the area; conversely most horizons that have shows eventually produce commercially over at least part of the area. Shows have been widespread regionally and vertically from the shallow oil in the Rico at Mexican Hat to the deep gas at Barker Dome.

Although there are fewer than 30 localities in which a full Pennsylvanian section has been drilled (in some localities more than one well has been drilled, such as at Barker Dome, Dove Creek, and Montecello) all except a very few have reported shows, usually in more than one horizon. Of these, Barker Dome is a very large gas reserve. Boundary Butte has an undetermined gas reserve. Rattlesnake has one well which produced 357,000 bbl. of oil, and two dry holes. Dove Creek has one gas-distillate well with an initial capacity of 5 million feet of gas and 400 bbl. 65°-gravity distillate (but an unknown sustained productive capacity) and four dry or noncommercial wells. At least three of the dry holes at Dove Creek had zones with shows. In some the porosity had been destroyed by secondary mineralization with calcite or gypsum. (Many of the structures in West Texas are barren on the crests and one flank in the upper Permian because of the destruction of the porosity by secondary mineralization.)

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A very slight improvement in the porosity and permeability in these zones would result in commercial production.

Pennsylvanian.—Hathaway's State Line well, some 1,100 ft. structurally downdip from the nearest Dove Creek well, cored 17 ft. of vugular, bleeding lime similar in appearance to that of the Scurry County reef. On a production test it made some oil with water. There were two other zones with some pin-point porosity, one of which was tested for a small amount of water and oil. This is an attractive area for continued exploration. About 90 miles to the northwest, Tide Water Associated's Big Flat well reported numerous shows in the Pennsylvanian above the salt and thick vugular zone below the salt with some oil. This latter zone has been called Mississippian but may be Pennsylvanian.

It is worthy of mention that both this zone and the gas-producing zone at Barker Dome are rich in sulfur whereas all other shows in the Pennsylvanian have been sweet oil or gas. There have been only a fraction of the number of wells drilled through the Pennsylvanian in this area as were drilled in the reef area of West Texas prior to the discovery of the rich Scurry fields. These rocks should eventually prove as productive. It is well to emphasize that the traps will probably be stratigraphic and not necessarily dependent on closed structure.

Pre-Pennsylvanian rocks.—The Mississippian is usually dense but in some localities has shown thick porous zones and produces at Table Mesa. The frequent occurrence of noninflammable gas, which is probably derived from the Tertiary volcanic intrusions, in no wise condemns the Mississippian rocks as prospective producers. The well control is even more limited than that of the Pennsylvanian which adds to the hazard of prediction. It should, however, produce profitably in many localities and because of known variation in porosity the occurrence of oil may not always be controlled by structure.

The Ouray member of the Devonian is thought to be the most attractive horizon of the Four Corners area. It is universally porous and oil staining and shows have been widespread. It should produce from structures of appropriate age. Structures where it has shown staining and produced noninflammable gas should be further explored. The Devonian has been a prolific producer in many parts of the world. The differences in thickness of the Devonian and Mississippian in wells in the Nucla area suggest early folding.

The Ordovician has been identified in only two wells, at Pure's Horsefly and at Boundary Butte. The age determination at the latter place is verified by fossil evidence. Shows were reported at Boundary Butte. Its excellent production in the Mid-Continent is enough to warrant the prediction that it will probably also produce in this area.

The Cambrian has been tentatively identified in Shell Oil Co.'s Bluff well, where shows were reported, and at the Pure's Horsefly. Its character is such that it could produce, but its continental history is not such as to cause one to believe that it will be very prolific.

BOOKS

IRA RINEHART'S OIL AND GAS DIGEST. Published monthly by Rinehart Oil News Co., of Dallas. $10 each to subscribers; $15 each to nonsubscribers.

This new monthly publication is a comprehensive summary of well-completion information covering current discoveries, important extensions, and significant dry wildcats in Texas, Southeast New Mexico, and South Louisiana. Each well is reported on a separate page with completion data and electrical log of pay section printed on the front side and a plat of the area on the back. The March issue, first to come off the press, is devoted to 92 wells. The new service will be available from the first of the year with volumes covering January and February to be published soon. The digests are in a convenient pocket-size format, permanently bound, yet pages can be removed easily and adapted readily to conventional card file or loose-leaf systems.

WICKES

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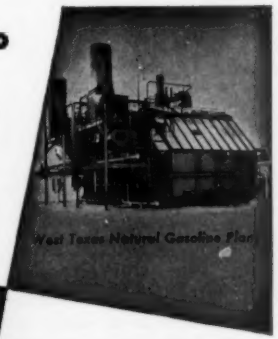
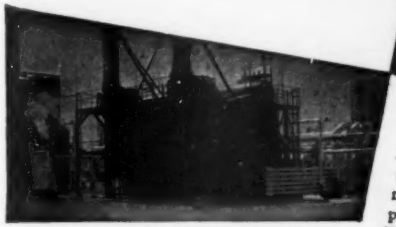
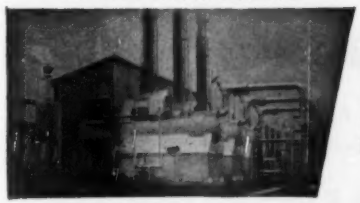


West Texas Natural Gasoline Plant



Central Texas Natural Gasoline Plant



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RECORDS FELL as this western Oklahoma wildcat, using a heavy Gulf Coast-type rig, was drilled by Phillips Petroleum and associates.

New Drilling Record Set for Deep Oklahoma Well

Wildcat reaches 15,077 ft. in 266 days. Only four fishing jobs were occasioned, all above 5,400 ft.

by Neil Williams
Associate Editor

A RECORD for fast drilling of a 15,000-ft. well in Oklahoma is believed to have been set by Parker Drilling Co., the contractor, in putting down Phillips Petroleum Co. and associates' rank wildcat test, 1 J. M. Flynn, located 6 miles north of Sayre, northwestern Beckham County, in the extreme western part of the state.

Spudded June 26, 1951, the well, on March 18, 1952, only 266 days later, was at a depth of 15,077 ft. with a string of pipe cemented on bottom. At that depth, operators had elected to stop, due to high gas pressures being encountered, and test the well, in which approximately 200 ft. of net, porous potential oil or gas pay had been logged in the Pennsylvanian - Deese granite wash section below 14,200 ft. to bottom. Deepening operations were begun on this well about the middle of April.

Hole was drilled to 11,535 ft., original projected depth, with Howell & Howell of Dallas and Walter Duncan of Oklahoma City as operators. At that depth, following unitization of leaseholdings, totaling 3,120 acres, in the immediate area, Phillips Petroleum Co., with 38.5 per cent interest in the unit, was designated as the operator to carry the hole to 15,000 ft.

The fast time made in drilling the well is attributed to a large extent to the precautions taken by the contractor to prevent trouble and minimize changes of drilling delays either from mechanical or operational failures. Not only was an extra-heavy-duty, deep-drilling, Gulf Coast-type rig specially assembled for the job from the contractor's reserve equipment, but some of the contractor's most experienced personnel were assigned to the operation. The latter included J. P. Wagnon, superintendent, and Frank Howard, tool pusher, each with 25 years' drilling experience, and Gentry Plemons, relief tool pusher, with 20 years' experience.

Indicative of the precautions taken, there were only four fishing jobs, all above 5,400 ft. and none serious, costing a total of only 24 hours lost time. The first, at 1,100 ft., involved recovery of one 8-in. drill collar, and required only 8 hours. The others, occasioned by drill-pipe twistoffs and costing only 4 hours each, were at 4,000, 4,800, and 5,400 ft., respectively.

Drilling Program

Drilling was started with 140 ft. of 16-in. conductor pipe, cemented with 200 sacks of cement in 19¼-in. hole. The salt string consisted of 3,170 ft. of 40-lb., 9⅝-in. casing, cemented with 1,500 sacks, with plug down 12 days after hole was spudded. Hole for the salt string was started with 13¾-in. bit, and then reduced to 12¼ in. Hole below the salt string was drilled with 8¾-in. bits to 13,538 ft., where a string of 7-in. combination-weight pipe (heaviest 35 lb.) was run for protection. This was cemented with 300 sacks of cement containing 4 per cent gel. Plug was down 211 days after the hole was spudded.

The remainder of the hole was drilled with 5⅞-in. bits. High gas pressures encountered in this portion of the hole presented hazards but were bled off successfully. However, at the bottom, when the gas began cutting the drilling mud from a weight of 14 lb. to from 10 to 12 lb. per gal., operators elected to run a liner string. This consisted of 1,600 ft. of 5-in. pipe, and was cemented with 120 sacks of cement containing 4 per cent gel.

Bits used on the well totaled 183. They included the following bit sizes and numbers: 19¼-in., 1; 13¾-in., 1; 12¼-in., 4; 8¾-in., 130; 5⅞-in., 46; 4½-in. (used in drilling out cement in liner), 1.

(Continued on page 139)

Hole was drilled to 5,650 ft. with 4½-in. full-hole drill pipe; from 5,600 to 11,978 ft. with 4½-in. extreme hole pipe; from 11,978 to 13,550 ft. with 3½-in. modified pipe; and from 13,550 ft. to bottom with 2⅞-in. extreme hole pipe. Five 7½-in. o.d. drill collars with 5-9/16-in. full-hole, box and pin were used on the string to 3,200 ft.; fifteen 5¾-in. o.d. collars with 4-in. H 90 box and pin from 3,200 to 13,550 ft.; and eight 3⅛-in. extreme hole collars from 13,550 ft. to bottom.

Three 4,000-ft. by 1¼-in. drilling lines were used. However, the first, used in drilling to 9,800 ft., had had previous service, and the third, which replaced the second new line at 13,206 ft., was still in good condition when the hole was completed.

Drilling-mud costs totaled approximately $56,635, of which more than $39,262 was for the hole below 11,535 ft. after Phillips Petroleum Co. took over the operation. Mud materials used in the latter part of the hole included: Aquagel material, 4,392 bags; Baroid, 12,475 bags; sodium bicarbonate, 2,600 lb.; soda ash, 4,500 lb; caustic 18,160 lb.; quebracho, 2,600 lb.; Driscose, 3,100 lb.; and lost-circulation material, 20,700 lb.

The rig is a diesel-electric-powered assembly capable of drilling to at least 18,000 ft. Rig power is supplied by two Westinghouse d.c. generators (one 250-kw. and one 200-kw.) provided with two 20-kw. excitors, and driven by two Superior YRD 9 by 12-in. diesel engines, capable of 100 per cent overload. Draw works and pumps are driven by three 200-hp. and one 300-hp. motors, also capable of 100 per cent overload.

On the rig is a National 23-9F two-shaft three-speed draw works with 9-in. drum shaft, capable of spooling 2,800 ft. of 7¼-in. line or 3,500 ft. of 1⅛-in. line. Mud pumps include one C-350 7¾ by 18-in. pump and one C-150 6¾ by 12-in. pump, driven through a 600-hp. reduction gear. Three 28 by 7 by 5-ft. mud tanks, each with a capacity of 162 bbl., are provided.

Fluid Hydroforming . . . Full-Scale Unit

(*Continued from page 111*)

and silencer before release to the atmosphere.

Storage . . . The unit will be provided with a fresh-catalyst storage drum (not shown in Fig. 1). An eductor system will be used for fresh-catalyst unloading. Ceramic filters will be used to minimize loss of catalyst fines. Catalyst can be transferred to or from the unit while it is operating by the use of a catalyst transfer drum.

Type . . . The catalyst to be used will be molybdena-on-alumina which contains approximately 10 per cent molybdenum trioxide. The initial particle-size distribution will be about as follows:

	Per Cent
Finer than 20 μ	5 to 10
20 to 40 μ	Over 20
Coarser than 80 μ	Under 30

This distribution is similar to that obtainable in commercial grades of fluid catalyst cracking catalyst. The attrition resistance of the catalyst will be equal to or better than that of the more resistant grades of synthetic fluid cracking catalyst.

Catalyst discarded from a commercial fixed-bed hydroformer will be used to start up the unit, scour it out, and provide initial operating experience. This catalyst will be subsequently replaced by fresh catalyst available from commercial suppliers.

Process Control

The reactor pressure will be controlled by throttling the reactor effluent. The regenerator pressure will be controlled by throttling the flue gas. The regenerator temperature will be controlled by varying the catalyst bed level so as to change the submergence of the water tubes.

Bed level in the regenerator will be controlled by the slide valve in the regenerated catalyst standpipe. Bed level in the spent catalyst hopper will be controlled by the slide valve in the spent catalyst standpipe. The pressure drop across each of these slide valves will be approximately 5 psi. Bed level in the reactor will be fixed by the catalyst inventory of the system. The rate of catalyst flow will be adjusted by the plug valve and the rate of gas injection used in the spent catalyst riser.

Equipment

Vessels will be fabricated from carbon steel. Refractory liners will be used in the reactor, regenerator, and catalyst transfer drum. The standpipes will be 4-in. Schedule 160 carbon-steel tubing. High-temperature furnace tubes and the transfer lines will be of alloy. Single slide valves will be used in each of the standpipes, and a plug valve of special design will be used at the bottom of the spent catalyst riser.

Plot dimensions for the unit are approximately 145 by 145 ft. The elevation at the top of the spent-catalyst hopper is 125 ft.

Operating Flexibility

Allowance has been made for a high degree of operating flexibility in the design of the Destrehan unit. It will be capable of processing an unusually wide range of feed stocks, including high-boiling naphtha, mixtures of straightrun and cracked naphthas, and high-sulfur naphthas. It can produce benzene or toluene, or both, by proper selection of feed stocks and operating conditions—although recovery facilities for these materials are not presently being provided.

Gas-recycle rate can be varied, and sufficient overcapacity has been included in the combustion-air compressor to permit catalyst regeneration at substantially more than the design rate. The naphtha-preheat temperature can be increased from the design temperature of 940° F. to a maximum of 1,050° F. The catalyst-to-oil ratio can be reduced from the design ratio of 0.35, or it can be increased to 1.0 or more. Provision has been made for the use of new and improved catalysts as they become available.

Process Results

The Destrehan fluid hydroformer is designed primarily for high-intensity operation to produce a high-quality hydroformate suitable for use either in aviation or motor gasoline. Lower-intensity operation at higher throughput will produce a lower-quality hydroformate suitable for use in motor gasoline.

TABLE 2—Motor-Gasoline Yields and Octane Numbers

Basis: Gasoline with a R.v.p. of 10 lb. and an end point of 400°F.		
F-1 octane number (without TEL Addition):	95	85
Naphtha-feed rate, barrels per stream day	2,000	2,750
Products:		
Gasoline yield, per cent by volume	87.2	101
Extraneous butanes included, per cent by volume	3.2	10
Gasoline, bbl. per stream day	1,744	2,777
Dry gas, lb. per hour	2,730	1,890
Catalyst deposit, lb. per hour	110	110
Octane numbers for motor gasoline:		
F-1 (without TEL addition)	95	85
F-1 (with addition of 3.0 ml. TEL per gal.)	101	96
F-2 (without TEL addition)	84	76
F-2 (with addition of 3.0 ml. TEL per gal.)	90	85

TABLE 3—Aviation-Gasoline Yields and Octane Numbers

C_5's to 335°F.-end point gasoline: Yield, per cent by volume	74
F-3 blending octane number (with addition of 4.6 ml. TEL per gal.)	97
F-4 blending index number (with addition of 4.6 ml. TEL per gal.)	165
7-lb.-R.v.p. 335°F.-end point gasoline: Yield (with isopentane added), per cent by volume	94.6

Motor-gasoline yields and octane numbers for both types of operation are shown in Table 2. Aviation-gasoline yields and octane numbers for the

high-intensity operation are shown in Table 3. The design feed stock boils at temperatures between 220° and 335° F. and it has an A.P.I. gravity of 53° and an F-1 octane number of 60 without TEL addition.

Although the catalyst deposit, as shown in Table 2, is 110 lb. per hour, the regeneration load is greater in terms of carbon equivalent. Allowances for the hydrogen content of the catalyst deposit, for entrainment of hydrocarbons with catalyst which passes to the regenerator, and for oxidation of metallic constituents of the catalyst require air for combustion of 280 lb. per hour of carbon equivalent.

Operating Costs

The normal utilities' requirements for high-intensity operation at a throughput of 2,000 bbl. per stream day are shown in Table 4. Estimated operating costs are shown for the high-intensity operation at low throughput, and for the alternative operation at lower intensity and higher throughput. The utilities costs are based on fuel gas at 3 cents per gallon of fuel-oil equivalent, and steam at 40 cents per 1,000 lb. It has been assumed that two men, with supervision, will operate the unit. Maintenance and miscellaneous costs are a fixed percentage of the investment.

TABLE 4—Normal Utilities' Requirements
Basis: Gasoline with an R.v.p. of 10 lb. an end point of 400°F. and an F-1 octane number of 95 without TEL addition

Steam	
Consumed:	
400-psig., lb. per hour	4,400
125-psig., lb. per hour	2,650
Produced:	
250-psig., (98 per cent quality), lb. per hour	3,250
30-psig., lb. per hour	2,650
Cooling water:	
90°-F. supply (30°-F. rise), g.p.m.	1,680
Boiler feed water, gal. per min.	7
Power:	
Drives and lighting, kw.	130
Fuel gas (fuel-oil equivalent):	
Furnaces, bbl. per stream day	160
Air and gas compressors, bbl. per stream day	20

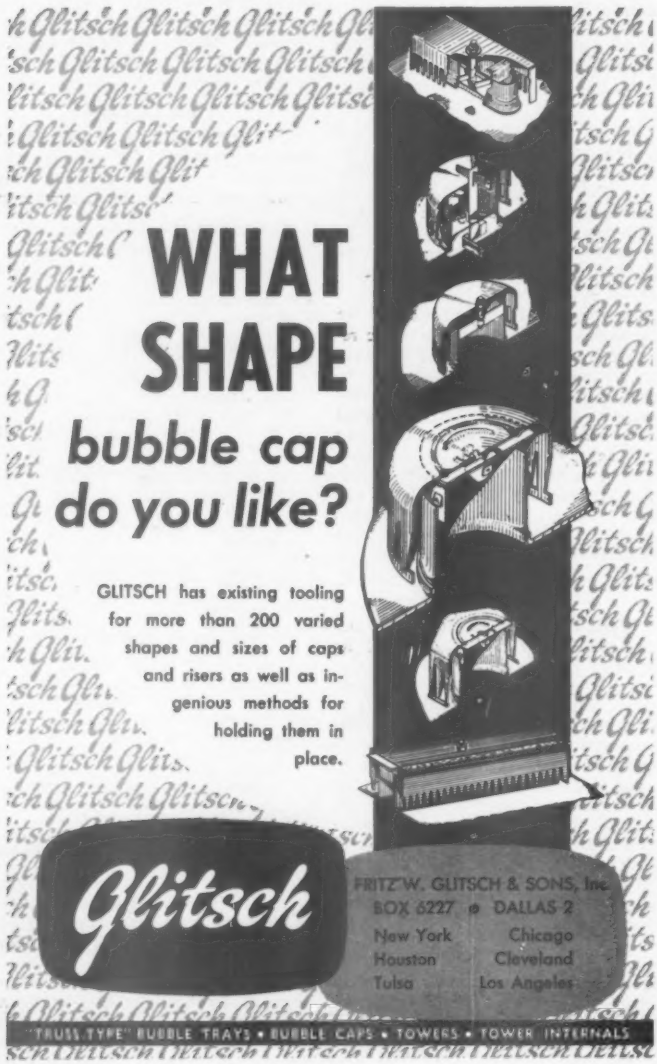
TABLE 5—Estimated Operating Costs
Basis: Gasoline with an R.v.p. of 10 lb., and an end point of 400°F.

F-1 Octane Number (without TEL addition):	95	85
Naphtha feed rate, bbl. per stream day	2,000	2,750
Operating costs, cents per barrel of feed:		
Utilities	15	12
Catalyst	5	4
Labor	8	6
Maintenance and miscellaneous	12	8
	40	30
Fuel-gas credit	15	8
Net	25	22

As indicated in Table 5, the type of operation will influence the direct operating costs. Under high-intensity conditions the direct cost is approximately 40 cents per barrel of feed; at the lower intensity, this is reduced to 30 cents. If credit is taken for the fuel value of the dry gas produced, the utilities costs are reduced, respectively, 15 cents and 8 cents per barrel of feed. The resulting net costs are 25 cents per barrel of feed for the high-intensity operation, and 22 cents for the lower intensity.

Acknowledgment

The authors wish to express their appreciation for the cooperation and assistance of M. W. Kellogg Co., of New York, in connection with the preparation of this report. Kellogg Co. did the basic pilot-plant work on the Destrehan feed stock; designed and engineered the unit; and has also done the construction work.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Fluid Hydroforming . . . Pilot Plant

(*Continued from page 110*)

perienced, even though catalyst particle size was varied rather widely from time to time.

The engineering investigations covered such items as fluidized solids den-

sities, heat-transfer coefficients, catalyst-entrainment rates, and cyclone-recovery performance. Also process data were obtained on key operating variables. In addition, the continuous operations made it possible to evaluate the performance of several catalysts as regards life characteristics and attrition.

Yield Structure

The emphasis in the large pilot-plant operations was on reforming at levels above 90 C.F.R.-R. clear because operations at the higher levels, particularly in the 95 to 100 C.F.R.-R. range, are believed to be of greatest interest for future refinery operations. Several catalysts have been used in the pilot plant, but the results presented here were obtained on one type of molybdena-alumina catalyst.

Typical results obtained from processing a 200° to 300° F. Louisiana-Mississippi virgin naphtha are shown in Figs. 1 and 2. The product distribution varied significantly with reforming intensity. As the intensity was increased from 90 C.F.R.-R. to 100 C.F.R.-R. clear octane number, the yield of C_5 to 430° F. naphtha product decreased from 82.3 to 71.4 per cent

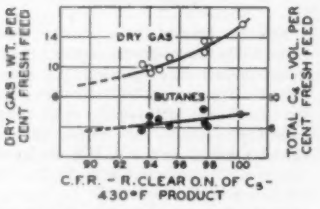


Fig. 1—Butane and dry gas yields, fluid hydroforming.

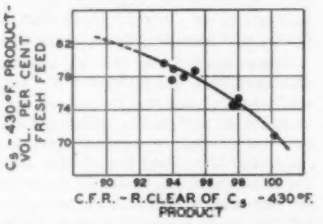


Fig. 2—Hydroformate yields, C_5 to 430° F. end point.

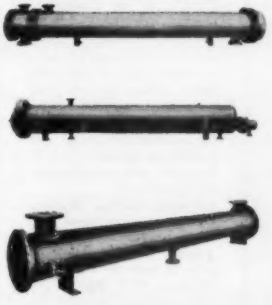
by volume on fresh feed. Total butane yield increased somewhat, but the bulk of the feed-stock degradation was to gas which increased from a yield of 7.8 per cent by weight on feed up to 15.5 per cent by weight. The carbon yield increased simultaneously from approximately 1.2 per cent by weight on feed to 1.6 per cent by weight as the reforming level increased. Polymer amounting to less than 0.5 per cent by volume on feed was also formed.

Yield-octane relationships obtained in the large pilot plant duplicate results obtained in the bench-scale isothermal units where selectivity has always been quite high. It is pertinent to note also that the yield of C_5 to 430° F. naphtha from the large pilot plant did not drop off sharply as reforming intensity was increased even to levels well above 95 C.F.R.-R. clear. The reasons for this have already been discussed; i.e., that thermal degradation losses have been minimized or eliminated by applying the fluidized solids technique so as to make the reaction proceed isothermally.

No loss in catalyst effectiveness resulted from high-level reforming. Continuous regeneration maintained catalyst activity at a fixed level throughout the operations described, as well as in operations which followed on the same catalyst.

As in other catalytic processes, the yield structure can be altered by the catalyst used. The amount of hydrocracking which takes place, for example, can vary significantly. One catalyst type tested in the large pilot plant doubled the butane yields which were obtained with the catalyst discussed previously. In certain refinery applications such a yield structure may be desirable. Further catalyst development work is in progress, and it may

AND SAW A PROBLEM



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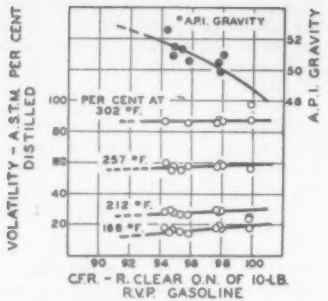

Fig. 3 — Hydroformate - product inspections, fluid hydroforming.

TABLE 1—FLUID HYDROFORMING VARIOUS STOCKS

Feed stock—	Louisiana-Mississippi	Mid-Continent blend
Feed inspections:		
A.S.T.M. initial boiling point, °F.	211	284
A.S.T.M. end point, °F.	350	396
Naphthenes, per cent by weight	39	38
Aromatics, per cent by weight	14	12
C.F.R.-R. clear	50.6	30
C_5 to 430° F. naphtha, C.F.R.-R. clear	95.0	95.0
Product distribution:		
C_5 to 430° F. naphtha, per cent by volume	78.3	76.4
Total C_4, per cent by volume	6.7	6.4
Dry gas, per cent by weight	10.4	13.4
Polymer, per cent by volume	0.3	0.3
Carbon, per cent by weight	1.5	1.2

well lead to improved yield-octane relationships.

Product Characteristics

The naphtha product obtained from hydroforming requires no further treatment. In fact, the hydroformate as produced is essentially a finished gasoline, which requires only some extraneous butanes for vapor pressure. Fig. 3 shows the volatility characteristics of hydroformates produced in the large pilot plant.

Relatively little change in volatility occurred as reforming intensity was varied. However, the gravity of the gasoline decreased, reflecting the increased aromatic content of the product.

Feed Stocks

Results obtained from processing an appreciably lower-grade naphtha were quite similar, although slightly poorer. Somewhat higher in boiling range than the Louisiana-Mississippi stock discussed previously, this Mid-Continent naphtha blend had a C.F.R.-R. clear rating of 30 compared with 50 for the Louisiana-Mississippi stock.

A comparison of the product distribution obtained from hydroforming these stocks in the large pilot plant is summarized in Table 1, which also includes pertinent feed-stock properties.

The yield of C_5 to 430° F. naphtha obtained from the 30 C.F.R.-R. feed stock was 2.2 per cent by volume lower at the 95 C.F.R.-R. reforming level, and the C_4 yield was about the same. However, the important point illustrated by these results is that naphthas of such widely different initial octane ratings can be upgraded to high octane levels with substantially the same high selectivity.

Refinery Applications

Catalytic reforming processes are being installed today either as motor-gasoline improvement projects, or as specialty projects for producing aromatics or aviation-base stock, or as a combination of the two. The major interest, from a long-range standpoint, lies in its application to motor-gasoline improvement.

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FULL-SCALE HYDROFORMING

(*See page 135 for continuation of article*)

reforming is in direct competition with the combination of thermal reforming plus catalytic polymerization. However, the need for considering new equipment installations arises from different refinery circumstances. The simplest is the one where crude-run capacity is being currently increased, and where new naphtha reforming capacity must also be installed simultaneously.

Another similar and commonplace situation is the one where crude-running capacity has been increased gradually over a period of years, but with no corresponding increase in naphtha-reforming capacity. In other instances competition has made it necessary to increase the intensity of thermal reforming to levels such that octane improvement is achieved at prohibitively high costs. Common to all is the belief that octane-number levels of marketed gasoline will continue to increase in the future.

Economic evaluations show that fluid hydroforming is more attractive than the combination of thermal reforming plus polymerization. Pertinent factors in this comparison are summarized in Table 2. The situation is a hypothetical one assuming that 10,000 bbl. per stream day of 50 C.F.R.-R. clear 200° to 350° F. virgin naphtha is reformed to produce a 91.5 C.F.R.-R. clear 10-lb.-R.v.p. gasoline. Hydroforming is carried out at a level of 90 C.F.R.-R. clear C_5 to 430° F. naphtha basis. The cost structure is typical of that which currently prevails in the Gulf Coast area.

The on-site investments given in Table 2 include fractionation, absorption, and stabilization equipment for each process. Utilities investments include steam-generation and distribution facilities, cooling-water equipment, and power substation and distribution facilities. The power itself is purchased.

On-site investment for the thermal reforming installation is about 30 per cent lower, but the product credits for the fluid hydroforming case are significantly higher. The higher credits result primarily from the high gasoline yield obtained from the fluid hydroformer installation. Net-product credit for the hydroforming operation is $3,040 per calendar day, but operating costs are $980 per calendar day higher — giving a net advantage of $2,060 per calendar day, or $750,000 per year, to the hydroforming case. Return on the added on-site investment of $1,200,000 is 63 per cent after depreciation and overheads, but before federal income taxes. The return for the fluid hydroforming process is, therefore, quite attractive.

An additional credit can be claimed for the fluid hydroforming case in the foregoing comparison because a 930-bbl. per stream day increase in gasoline production was also realized. To obtain a gasoline-production increase of this amount by expanding a refinery along conventional lines may require an investment of about $1,500,000. This additional credit is a significant one in an expanding gasoline market, and should be weighed carefully in comparing the two processes.

Reforming to 90 C.F.R.-R. clear levels is adequate to meet the needs forecast for the immediate future. There are, however, certain advantages to be gained by designing and operating fluid hydroforming plants at a 95 C.F.R.-R. clear level rather than at 90 C.F.R.-R. The higher-intensity operations provide additional flexibility in producing specialty products such as premium motor-gasoline components, rich-mixture aviation-base stock, and aromatic solvents. The economics involved for a normal

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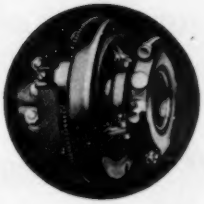

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Pilot-Plant Hydroforming

(*Continuation starts on page 136*)

motor-gasoline operation also favor the 95 C.F.R.-R. operation.

The investment for a 95 C.F.R.-R. fluid hydroformer is somewhat greater than that for a 90 C.F.R.-R. plant of the same throughput. However, to meet a given pool octane-number requirement, less capacity is required for a 95 C.F.R.-R. hydroformer, and the investment required is accordingly lower because of size differences. A comparison of operations at these two reforming levels is given in Table 3, which summarizes a refinery situation where 10,000 bbl. per stream day of 50 C.F.R.-R. virgin naphtha is upgraded to 91.5 C.F.R.-R. clear 10-lb.-R.v.p. octane number. In the 95 C.F.R.-R. hydroforming operation only 8,150 bbl. per stream day of the virgin naphtha is reformed, and the result is an on-site investment saving of roughly $250,000.

Utilities investment savings are also obtained, making the total capital saving about $380,000. In addition, 10-lb.-R.v.p. pool gasoline production increased 80 bbl. per stream day. The net-product credits to the 95 C.F.R.-R. operations are thus in the order of $76,500 per year, and operating-cost savings are also lower by approximately $125,000 per year for the generalized situation evaluated; i.e., a total credit of roughly $200,000 per year is realized in addition to an investment saving of $380,000.

In short, the preferred reforming intensity may be at levels considerably higher than the minimum required to satisfy current octane-number requirements. The generalized evaluation indicates 95 C.F.R.-R. operations to be more attractive than operations at 90.

The fluid hydroforming process has been developed to a stage where its commercial application merits consideration by any refinery faced with a naphtha-upgrading need. Economically,

TABLE 2—COMPARISON OF FLUID HYDROFORMING WITH THERMAL REFORMING PLUS POLYMERIZATION

Process—	Thermal plus polymerization	Fluid hydroforming
Naphtha feed (bbl. per stream day)	10,000	10,000
Process yields:		
Dry gas, per cent by weight	15.7	7.8
Total C_4, per cent by volume	5.3	5.6
C_5 to 430° F. naphtha, per cent by volume	74.7	82.3
Tar or polymer, per cent by volume	3.4	0.3
Coke, per cent by weight		0.3
10-lb.-R.v.p. gasoline:		
Extraneous n-C_4, per cent by volume	3.5	4.9
10-lb.-R.v.p. product, per cent by volume	83.5	92.8
C.F.R.-R. clear	91.5	91.5
Investments:		
Process on site*	$2,950,000	$4,150,000
Utilities†	370,000	750,000
Total	$3,320,000	$4,900,000
Operating cost per calendar day	$2,945	$3,925
Economics: Fluid vs. thermal reforming:		
Net-product credits per calendar day		$3,040
Operating-cost debit per calendar day		$980
Net credit, BFIT‡ per calendar day		$2,060
Return on increased investment:		
On site only		63 per cent
On site plus utilities		48 per cent

*Includes fractionator, absorber, and stabilizer. †Electric power purchased. ‡Before federal income taxes.

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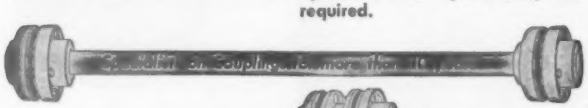

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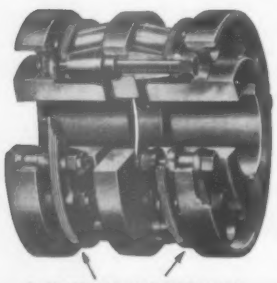

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the process is considerably more attractive than thermal reforming plus catalytic polymerization because gasoline yields are much higher. In addition, the flexibility which results from the fluid system makes it feasible, from both operating and economic standpoints, to reform at intensity levels as high as 95 to 100 clear C.F.R.-R. These levels are particularly desirable for producing specialty products or premium-motor or aviation-gasoline components. From a process standpoint, operation of the 50-bbl. per stream day pilot plant has demonstrated the advantages expected for the fluid hydroforming process.

TABLE 3—DESIGN AND OPERATION OF FLUID HYDROFORMERS AT 95 VS. 90 C.F.R.-R. CLEAR OCTANE LEVELS

	Hydroforming severity	
C.F.R.-R. clear: C_5 to 430° F. end point	90.0	95.0
Virgin naphtha (200° to 350° F. product):		
To hydroformer, bbl. per stream day	10,000	8,150
Not processed, bbl. per stream day	0	1,850
Total available, bbl. per stream day	10,000	10,000
Hydroformer yields:		
Dry gas, per cent by weight	7.8	10.4
Total C_4, per cent by volume	5.6	6.7
C_5 to 430° F. naphtha, per cent by volume	82.3.	78.3
Polymer, per cent by volume	0.3	0.3
Coke, per cent by weight	1.3	1.5
10-lb.-R.v.p. pool gasoline:		
C.F.R.-R. clear	91.5	91.5
Hydroformate, bbl. per stream day	8,730	6,950
Virgin naphtha, bbl. per stream day	0	1,850
Extraneous n-C_4, bbl. per stream day	490	600
Total pool, bbl. per stream day	9,320	9,400
Investments:		
Process on site*	$4,150,000	$3,900,000
Utilities†	750,000	620,000
Total	$4,900,000	$4,520,000
Operating cost per calendar day	$3,925	$3,585
Economics: 95 vs. 90 C.F.R.-R.:		
Net-product credits per calendar day		$210
Operating cost		340
Net credit per calendar day		$550

*Includes fractionator, absorber, and stabilizer. †Electric power purchased.

BOOK

THE PETROLEUM DICTIONARY. By Lalia Phipps Boone. Published by University of Oklahoma Press, Norman, Okla. 338 pp. $5.

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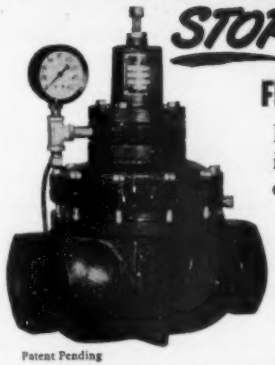

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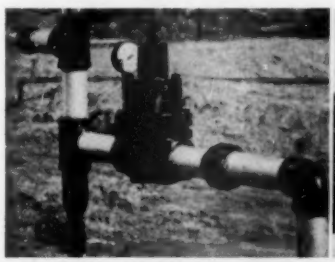

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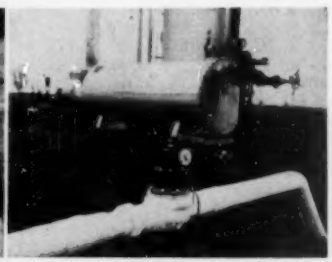

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Steel Rotary Hose

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A NEW all-steel rotary-hose unit has been designed for use specifically on portable drilling rigs to overcome problems encountered when drilling with such rigs where working radius is small. The hose has been thoroughly field tested.

The complete unit consists of a 6-ft. outrigger swivel arm bracketed securely to the mast leg and extending from the standpipe away from the derrick. This is designated as a "Space Saver." To this is attached a steel rotary hose incorporating ball-bearing swivel joints to permit complete flexibility and ease of operation in limited space. In turn, this is connected to the drilling-swivel extension which serves to increase flexibility of the hose.

The steel rotary hose is available in two types: The PRQ rotary hose features quick disconnects at each ball-bearing swivel joint to facilitate easy replacement of worn-out joints without excessive shutdown time. The PR rotary hose is adapted with a quick-disconnect union connection at one end of each swivel joint and a standard socket weld connection at the other end.

Both types are designed and engineered for practical maintenance and are available in lengths to accommodate most portable masts.

Other features.—The hose brings to the portable rotary rig all advantages of all-metal hose with ball-bearing swivel joints. It will not kink or twist and it eliminates possibility of a hose rupture causing loss of circulation or complete failure.

ROTARY-HOSE unit in operation with kelly in drilling position on Santa Fe Drilling's rig.

It provides uniform strength and safety from standpipe to swivel, and higher pump pressures can be accommodated with the hose. Extreme climatic conditions will not affect it, and the steel hose can be folded compactly and safely for easy and rapid movement.

The Space Saver and drilling-swivel connection are available and can be used separately with ordinary rubber rotary hose, although the developer, Chiksan Co., of Brea, Calif., recommends their use as a complete unit.

The advantages of the Space Saver in this application lie in eliminating rubbing of the hose against the mast leg and in increasing the radius of bend, thus reducing wear and tear of the rubber hose due to abrasion and kinking. The Space Saver can be transported without disassembling or removal from the mast.

When used in conjunction with the new drilling-swivel extension, shorter lengths of hose are required and the cost of the hose is proportionately reduced. Important, too, is the fact that the derrick floor is kept free of hose with the kelly in any position.

Pressure Regulators

To speed up the connections to fuel lines, Kellogg Drilling Co. sets the regulator and scrubber on the front end of the engine foundation. The tow bar of the unit serves as part of the fuel system by connecting the outlet from the regulator at one end of the tow bar, and the feed line to the carburetors at the opposite end. Raw fuel enters the small scrubber set on the bed plate so that only one lip union is necessary for making up the line after it has been laid to the engine.

Completion of This R&S *Built*
NATURAL GAS DEHYDRATION CONTROL PANEL

. . . represents a 4-way achievement of coordinated planning!

OAKFORD, huge storage operation owned jointly by New York State Natural Gas Corporation and Texas Eastern Transmission Corporation, is now going into operation to bring an increased volume of natural gas to consumers throughout the area depicted here and to other distribution areas extending eastward to the coast.

Ford, Bacon & Davis, Inc., well-known engineering and construction specialists, was selected to design and build the big compressor station at Delmont, Pa. The appointment is typical of the outstanding services coordinated by the owners to assure completion of the project.

When the Oakford compressing station is completed, it will be one of the world's largest, with a capacity of 30,000 H.P. One of its principal functions will be the dehydration of natural gas with a maximum flow of 400MMcf per day to a dew point of 0° or less at a pressure range of 400 to 850 psig, through a closed cycle process developed by F. B. & D. engineers. To provide automatic control of the dehydration cycles, Russell & Stoll, in collaboration with Ford, Bacon & Davis, designed and built the colorful control panel featured here.

THE PANEL IS BUILT BY R&S

Russell & Stoll custom built this natural gas dehydration control panel throughout. R & S explosion-proof enclosures and components were used, along with R & S Unilarms, pilot lights and push button stations, terminal boxes, fittings and other R & S equipment for Class I, Group D hazardous locations. The control panel was then sealed and tested by R & S and shipped as a single unit direct to Delmont, Pa., ready for installation.

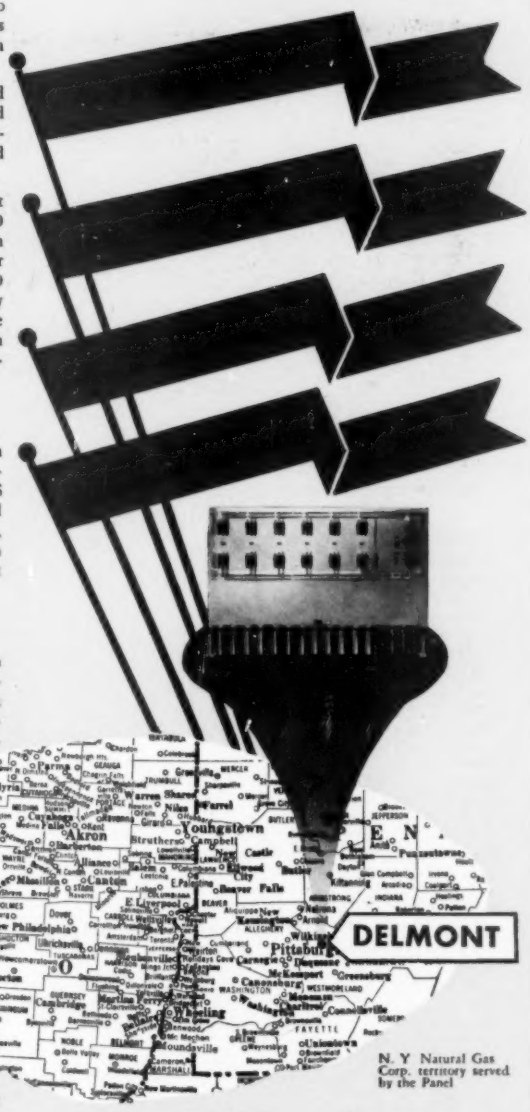
HOW THE PANEL WORKS

Basically, this control panel acts as a nerve and brain center of the gas dehydration process. By remote automatic control, it actuates 37 reversing starters mounted on six R & S panels which are located at the pipe line catwalks near the towers. These six panels control the opening and closing sequence of the motor operated valves on a predetermined operating cycle.

On the multi-colored face of the control room panel, you will note six symbolic towers. Each has its own outgoing conduits, as shown at the bottom of the panel, forming the interwiring connections to the valve motors and motor starter panels. Each has its grouping of pilot lights, which by their color and location when illuminated, indicate the operation then taking place.

The colored flow lines . . . the graphic outline of the compressor equipment . . . and the illuminated pilot lights of a specific cycle . . . all reveal the opening and closing sequence of the 37 motor valves and the flow changes of the gases through the towers. The drying, heating or cooling cycles are designated by the yellow, red and blue flow lines respectively.

A complete cycle of operation is four hours of drying, two hours of heating and two hours of cooling reactivation, in continuous sequence. At any time, four towers are being used for drying, one tower for heating and one tower for cooling.

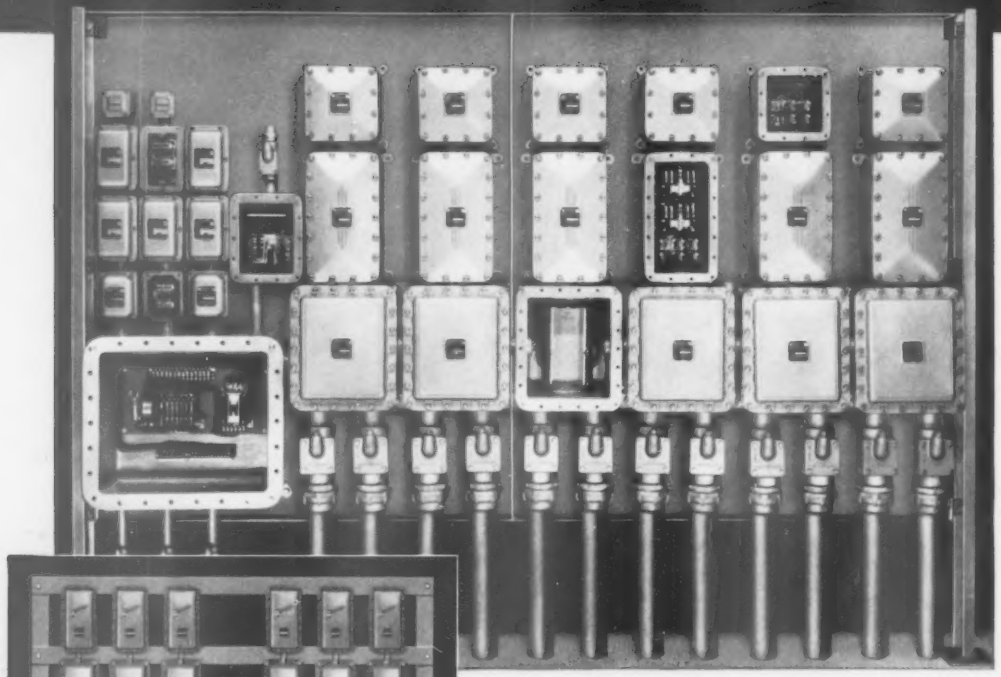


N. Y Natural Gas Corp. territory served by the Panel

The back page of this insert shows the manner in which R & S equipment and component units were installed on the rear side of the panel.

LIFT UP

R&S BUILT



Six R & S custom built motor starter panels, identical to the one shown here, mount 37 across-the-line reversing starters and circuit breakers to control the opening and closing operating sequence of the motor operated valves. These panels are all located on the pipe line and catwalks near the towers of the Oakford compressing station and are interwired with the natural gas dehydration control room panel.

50 ANNIVERSARY 1902-1952

This is the "working side" of the natural gas dehydration control panel Russell & Stoll custom built for the Oakford storage operation. Note the efficient functional group arrangement of all the R & S enclosures and components applied within the confines of the panel space.

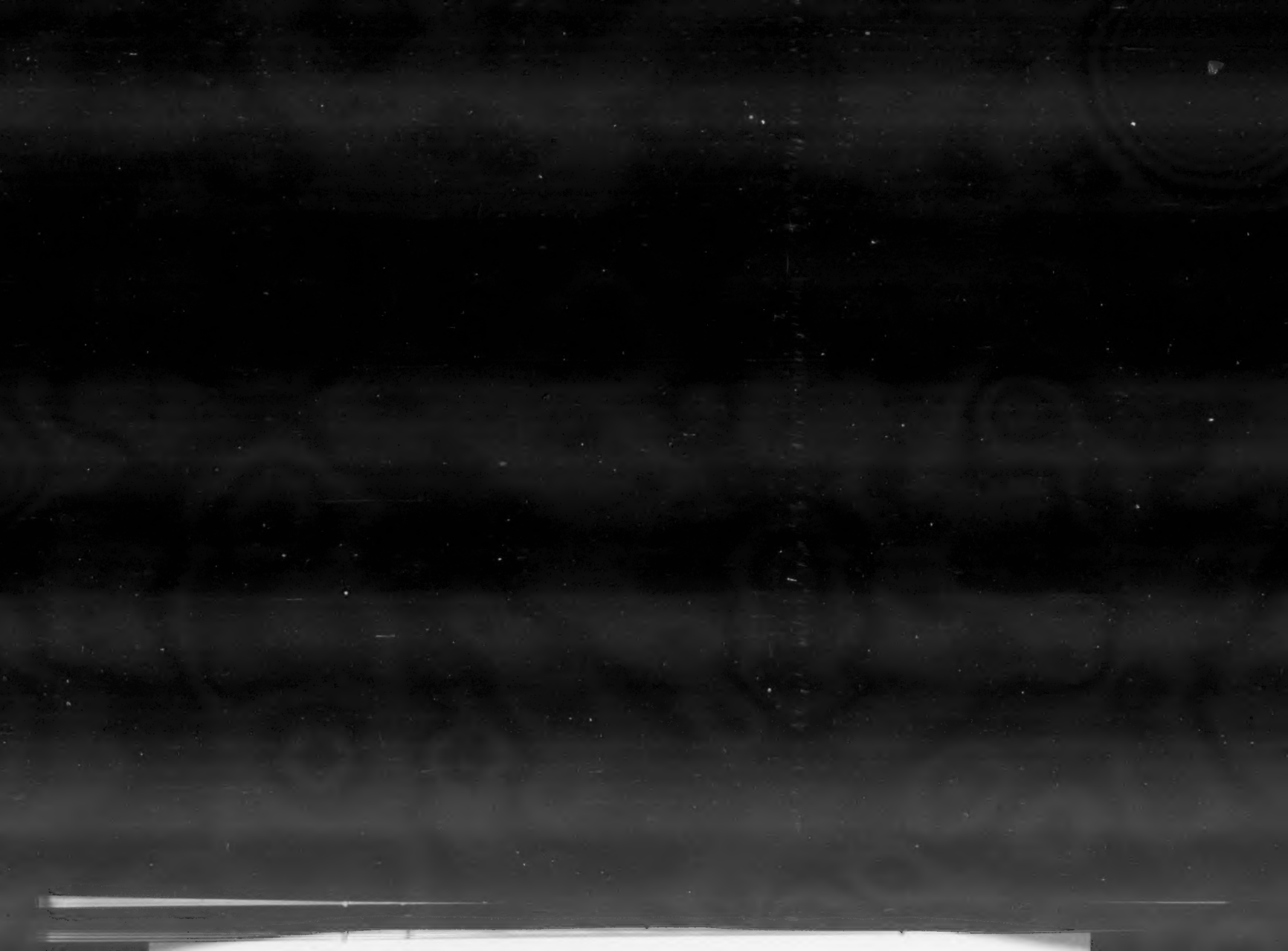
The illustration provides impressive testimony to the kind of rugged quality and precision manufacture R & S builds into hundreds of panels of every size and type, every year. Also, it typifies the variety of uses for which the complete line of R & S electrical specialties are specified today. And it emphasizes the widening scope of services we are rendering to the petroleum, chemical, utility and other fields of industry in this Golden Anniversary Year of the founding of the Russell & Stoll Company.

But more than that, it proves the *adaptability* of the Russell & Stoll organization to produce any kind of panel or panelboard for any kind of hazardous location. Moreover, it's an adaptability that can utilize many standard R & S equipment units as "packaged" components of standard or custom built panels — a faster, easier construction method that eliminates the delays of costly "special design" equipment.

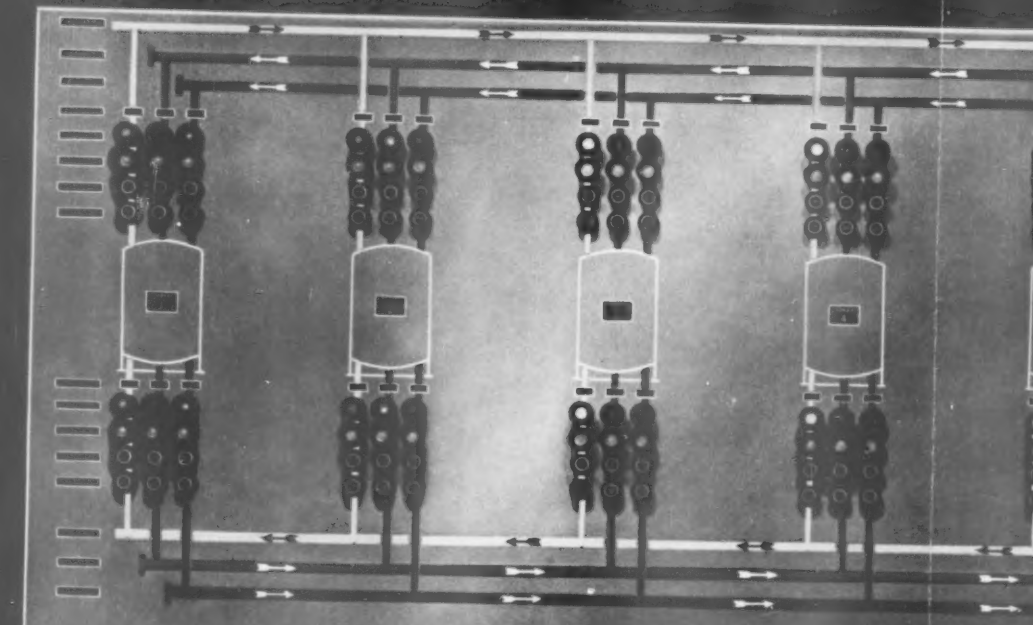
If you are concerned with the proper application of explosion-proof equipment to eliminate dangers to life and property in the wiring systems of your hazardous locations, why not investigate the R & S individualized approach to specific problems. Write us today.

RUSSELL & STOLL COMPANY, INC. • 125 BARCLAY STREET, NEW YORK 7, N.Y. G-1

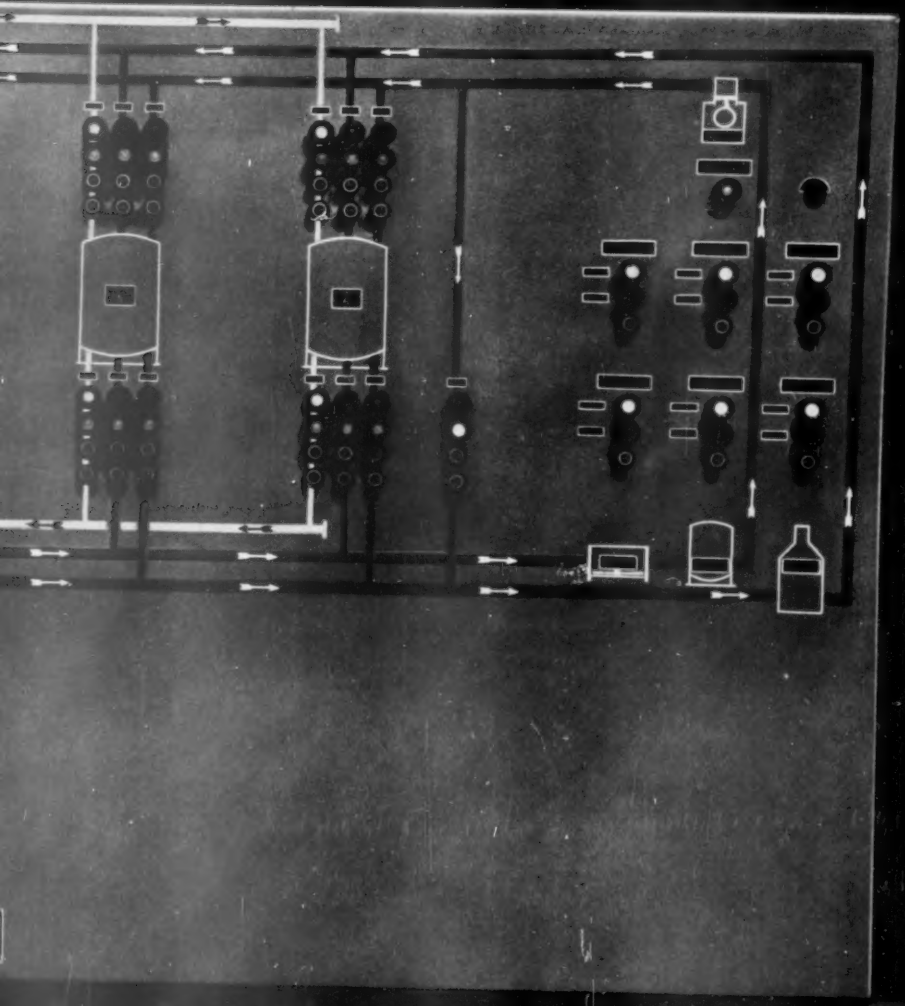
RUSSELL & STOLL

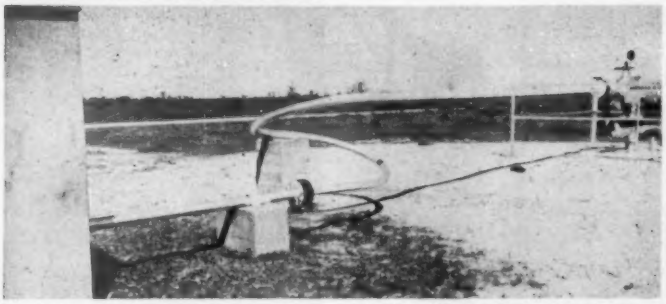


R&S Built *Natural Gas D*



Dehydration Control Panel





christmas tree to expansion and contraction changes far more severe than are normally met on a well producing at a regular rate.

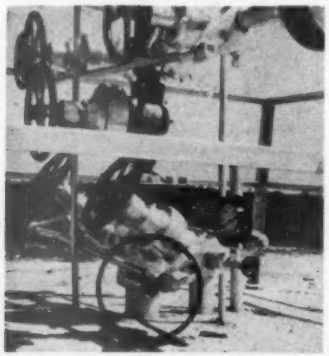
One company checks the tie rods of the branches of the trees on its injection wells at regular intervals. To insure that the proper socket wrench be at hand for the adjusting nuts on the rods, one is kept at each well. So that the socket wrench will be at the well when required, it is wired to one of the tie rods, and painted with aluminum, as is the remainder of the setting. The socket is thus inconspicuous, but readily found by the maintenance crew when the well is checked.

Flow-Line Expansion Curbed

INJECTION gas from the compressor station may reach an injection well at pressures and at temperature which may vary through a wide range, depending largely on the ground temperature on the flow line and the amount of gas being compressed. These factors may result in serious expansion in the line, which in turn results in severe stressing of christmas-tree connections.

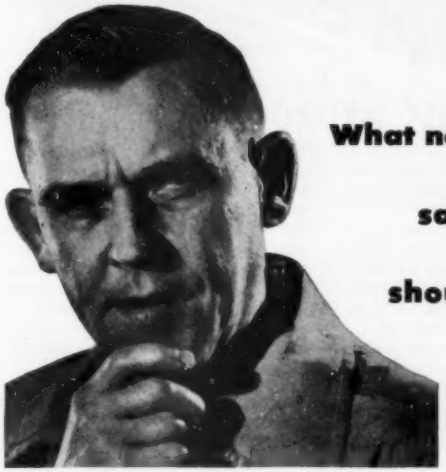
Instead of the usual "hairpin" or "omega bend" generally used to absorb expansion changes, one company uses a 360° helix or coil-type bend installed with the incoming run supported and clamped to a concrete block and with the midpoint on the bend supported by a steel plate installed at the correct angle in a block of concrete.

As the coil is simply resting on the support plate, diameter of the helix may change or the point of actual contact move up and down or across the plate. This permits the upper half of the helix bend and the straight run to the inlet valve on the christmas tree to move without any loading other than a portion of the weight of the connection.



Adjust Christmas Tree Tie Rods

INJECTION wells handling gas at high pressures and through a wide range of temperatures subjects the



What nonsparking safety tools should I buy?

Every day buyers are faced with the problem of replacing a steel tool with a nonsparking one for use on a hazardous job.

The obvious solution is copper, because of its well-known nonsparking quality. Unfortunately, pure copper is too soft to be serviceable. But with the addition of beryllium to copper, an alloy is obtained with the highest combination of hardness and toughness for safety tool applications. Further, the nonsparking feature of copper is retained, and the beryllium hardening content does not affect its nonmagnetic and noncorrosive advantages.

Where you need nonsparking safety tools, specify BERYLCO beryllium copper to be sure you are getting the top in strength and service life for your money.

Your best buy for safety PLUS strength—

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PEAK POLISH ROD LOADS ELIMINATED

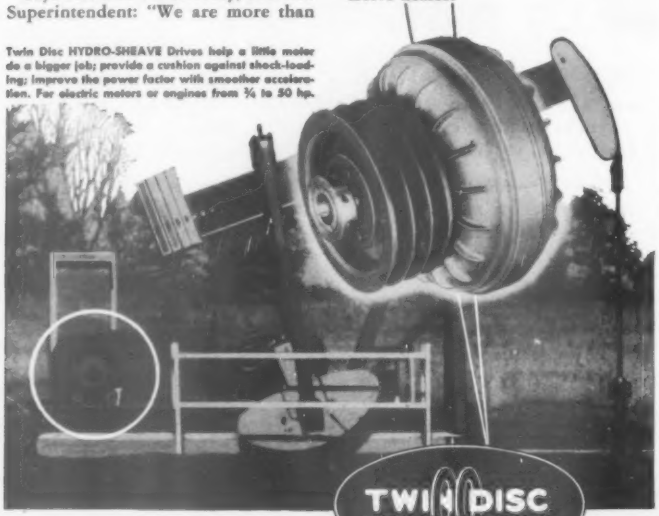
with TWIN DISC HYDRO-SHEAVE® DRIVES

Smoothing the power on 50 Cabot Pumping Jacks in the Ward S. Merrick holdings in the Graham Fox Pool and Bayou area of Carter County south of Lone Grove, Oklahoma, are Twin Disc's famous HYDRO-SHEAVE Drives. Bought to (1) increase pumping efficiency, (2) reduce initial motor cost, and (3) reduce excess current demands, these fluid drives *are* saving money on all three counts. That's why *more and more* HYDRO-SHEAVES dot the oil country.

Says Mr. Bob McChesney, Merrick Superintendent: "We are more than satisfied with the operation of the HYDRO-SHEAVE Drives due to smoother starting and the elimination of peak polish rod loads. Since using these units for the last three years we have had no belt failures. We are using 5 hp. motors on 4500 foot wells. Pumping units operating at this depth require 7½ hp. motors when not equipped with HYDRO-SHEAVE Drives."

Get the HYDRO-SHEAVE story from your nearest Twin Disc Hydraulic Drive dealer.

Twin Disc HYDRO-SHEAVE Drives help a little motor do a bigger job; provide a cushion against shock-loading; improve the power factor with smoother acceleration. For electric motors or engines from ¾ to 50 hp.



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CLUTCHES AND HYDRAULIC DRIVES

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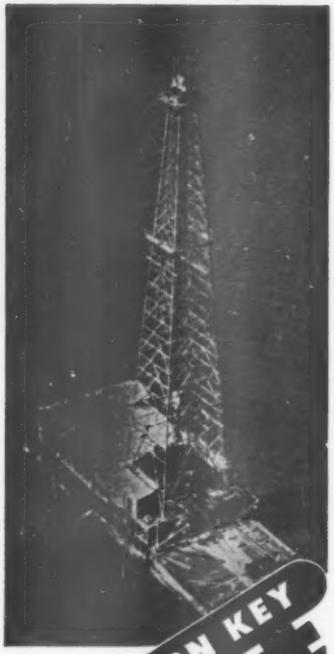

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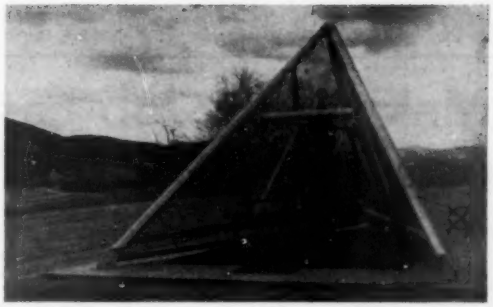
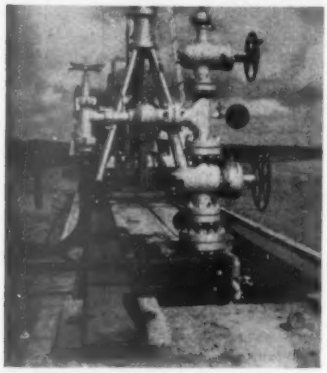
Pyramid Flood Protector



AT a well located in a normally dry river bed near Newhall, Calif., the heavily built pyramidal screen shown in the accompanying photograph was provided to protect surface equipment from debris during flash floods. Base of the tripod frame is about 10 by 20 ft., with the two longer legs pointing upstream. These upstream sides are covered with heavy expanded-metal mesh and are cross-braced for greater rigidity. The frame is anchored at all three corners with bolts which may be removed to allow the entire structure to be moved when desired. The structure may be skidded by tractor or truck; a tow line is attached to the upstream leg of the frame for this purpose.



Tracks for Long-Stroke Hydraulic Pumping Jack

IN Guijarral Hills field of California, one operator has installed 12-in. structural channel trackways at all wells equipped with long-stroke hydraulic pumping jacks so that the skid-mounted units can easily be moved in and out of pumping position. Concrete pads provide a level surface for the unit; bolts set in the concrete pads anchor the lengths of track. To support the tracks spanning the cellar opening, 10-in. I-beams are used.

By using a crowbar, and possibly a little grease or oil to reduce track friction, if necessary one man can move the pumping unit in and out of position.

Turn Your Ideas Into Cash!

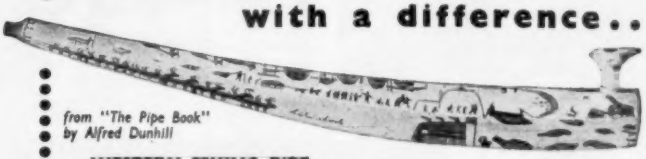
Do you have an idea which will save time, money, or effort on your job—either in the fields or in the plants? Then why not let others know about it?

The Journal pays cash for all acceptable items. Address yours to: Editor, "On the Job," The Oil and Gas Journal, Box 1260, Tulsa, Okla. Photographs and manuscripts will be returned if requested.

NUMBER SIX

PIPES

with a difference..



from "The Pipe Book" by Alfred Dunhill

WESTERN ESKIMO PIPE

This reproduction of a smoking pipe of walrus ivory is a fine example of Eskimo art. The scratched drawings are beautifully executed and show a house with chimney, a flag-staff, a herd of tame reindeer, and a large fishing net in use behind the igloo. The boring of the stem has been effected by cutting out a series of oblong panels, subsequently fitted back into place; the pipe can be cleaned by removal of a panel.

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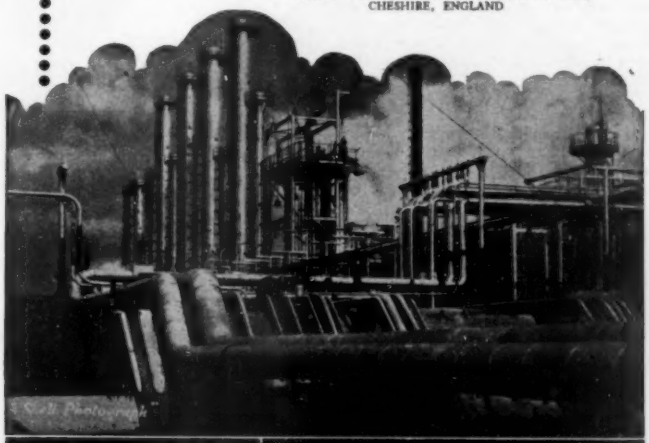


KENYON Planned HEAT INSULATION

KH 105

Making the Job Easier

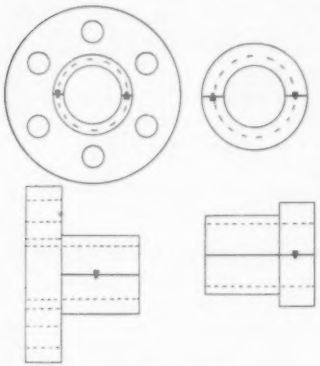
Three ideas now in practice by Sinclair Refining Co. at Houston result in saving, more efficient maintenance

THREE ideas put to practical use by Sinclair Refining Co., Houston, have resulted in easier work, more efficient maintenance, and added economy:

Split Packing Glands

Split packing glands have been installed on heater feed pumps at thermal cracking stills, which have eased maintenance chores considerably, since the split gland can be taken apart easily and cleaned.

Solid glands formerly had been



forming a cake between the gland and the rod causing the gland to become tightly affixed to the rod. Many times the glands were damaged in attempting to free them from the rods.

The glands were cut in half and sweated together with solder before being machined. Provisions were incorporated for fillister-head cap screws to be used for holding the split glands in position.

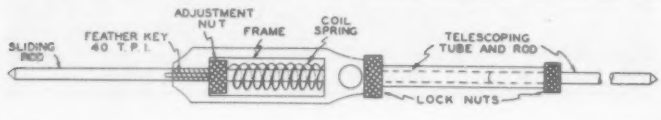
Telescoping Thread Gage

A telescoping thread gage has proven valuable for gaging all inside threads of large diameters. It has been especially useful for gaging inside threads out of reach of standard calipers or larger than 6-in. diameter.

The gage consists of a frame having a sliding rod on one end, which is backed up by a spring held within the frame. At the other end of the gage is a tube with a telescoping rod.

In using the gage the telescoping rod is set at an appropriate length using lock nuts, which are part of the gage. With the telescoped rod held against a thread, the sliding, spring-loaded rod would then be forced against the portion of thread diametrically opposite the telescoped end.

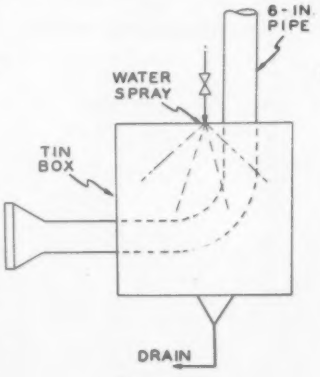
The sliding rod can be set in position with an adjustment nut and the gage removed for recording its setting.



Ell As Water Jacket

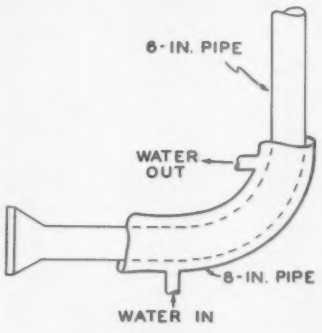
A cooling arrangement on a suction line to a condensate pump on the alkylation unit was improved by a changeover from a spray chamber to an improvised water jacket.

The original setup consisted of the water being sprayed over the ell



OLD TYPE

through perforated pipes set in a tin box. The spray was not efficient, and occasionally the pump would lose suction. Some water would also leak from the box from time to time and foaming would occur at the base of the pump.



NEW TYPE

The situation was remedied by cutting an 8-in. turn-tube ell in half and welding both halves around a 6-in. ell next to the condensate pump. Both ends were welded, leaving two 1-in. openings for connecting water lines.

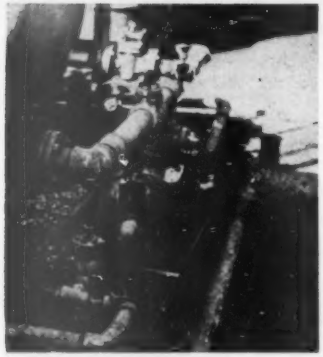
With this method a constant flow of water effectively cools the suction line.

"Hay-Barn" Tracks, Trolleys Used Above Catalyst Cases

When light loads are handled, such as pails of catalyst, the Co-Op at Mt. Vernon, Ind., has improvised with success, conventional "hay-barn" tracks and trolleys above the catalyst cases.

The trolleys and the track are conventional equipment commonly installed on the ridge pole of large hay barns to store loose hay with a spear or grab fork.

The support for the track above the catalyst cases is a light piece of structural steel supported at each end by vertical posts fitted with a braced cross member at the top. The track is attached to the horizontal support with machine bolts instead of welding, so repairs and/or replacements can be made easily.



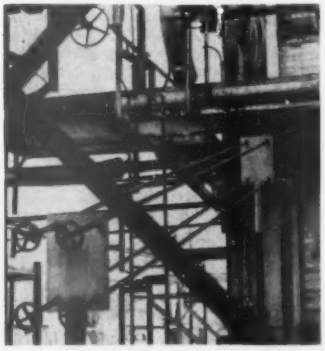
Splashproof Drainage Trough Used by Aurora Gasoline Co.

Instead of using conventional funnels to lead plant waste into sewage lines, a split-pipe trough is placed below the vent-gate nipples at Aurora Gasoline Co.'s Detroit plant.

This trough extends the full width occupied by the two horizontal processing vessels (see photograph) and is installed with a slope to insure full drainage. Both ends of the split-pipe trough are closed with flat half-heads, and the lower end is fitted with a nipple which fits into the sewage line at ground level.

The highest end of the trough is supported by a bracket, made of angle iron, which is clipped to one of the process risers leading to the process vessels. Vent lines for draining sediment and water are made up on the piping at a calculated angle which will prevent splashing.

Since splashing is practically elminated, the operator has better visual inspection to distinguish between discard and the product being treated.



Long Extension Stems Placed On Valves Aids Adjustment

Control valves on essential piping in the refinery of Newmex, Artesia, N. M., were of necessity installed beside the heater at an elevation too high to be operated by a man standing on the ground.

In order that these valves might be operated with a ladder, the company installed long extension stems which bring the hand wheels to a position convenient for operating.

Two supports are provided, one adjacent to the furnace, and the other some distance away. The supports contain square plates of metal welded to the posts, and provided with holes which act as a bearing for the extension stems.

Both plates are painted white as a contrasting background for black wheels so they can be reached at night under adverse lighting conditions.

"On the Job"—in the plants and in the fields, is designed especially for YOU! It offers ideas on how to make your work more efficient, and offers money savers, time savers, and labor savers.

If you've a suggestion which fills the bill, drop us a line. Mail to Editor, "On the Job," The Oil and Gas Journal, Box 1260, Tulsa, Okla. All photographs and manuscripts will be returned if requested.

7 out of 10 major oil companies

specify this new, improved

SPRING-MATIC LOADER

SO DO 228 OTHER PROGRESSIVE OIL COMPANIES

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The Oilco Spring-Matic is the achievement of many years of testing and perfecting in collaboration with the top technicians of the petroleum industry. Model 460, here pictured, introduces a new principle of hydraulic operation, yet it is interchangeable with counter weights. Its cam design holds the loader in fixed position while in use. Its static ground brushes dispense with added wire hook-ups. It has many other new features that make for ease, economy and trouble-free operation.

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Twin Atmospheric Pressure Blowcases Aid Acid Control

Another idea which is proving efficient at Newmex's refinery at Artesia, N. M., is the use of a set of twin atmospheric pressure blowcases constructed by the company to better control the feed of acid into the water basin of the cooling tower.

The cases were made by using short cylinders formed by cutting pipe and welding flat heads on each end. They were installed on tripods, made of round steel similar to sucker rods inbedded in concrete piers and topped with flat plates for the foundation of the blow cases.

Sight glasses installed on the side of the cases provide means of visual inspection when the operator checks the quantity of the chemical.

Atmospheric equalizers (tall pipes), with double ells at the top to prevent rainfall from entering the cases were welded into the top head.

The cases were installed near the acid storage tank, which in turn was set beside the cooling tower.

Receptacle for Special Wrench Keeps It Handy

When a special wrench is necessary to remove equipment or to make adjustments in the operation of instruments (such as an orifice fittings) much time is saved by Richfield Oil Corp.

On the oil and gas separator in the photograph a Daniels orifice fitting is installed in the vapor line.

The special socket wrench required to operate, or make adjustments of this fitting is set into a sleeve welded to a brace stabilizing the vapor line against the separator vessel.

The receptacle is made of a suitable pipe nipple by cutting a slot large enough for the crank to slide easily downward toward the closed end of the receptacle.

To prevent the wrench from being lost when moving, two lugs are welded on the side of the slotted nipple near the open end and drilled to receive a small retaining bolt.

A wing nut, easily removed by hand, holds the bolt in place so that it will not slip out when the separator is lifted onto a truck for moving.

PAINE DRILLING CO. SAYS . . .

"Thompson RATES HIGH WITH OUR CREWS

Because . . .

Thompson SEPARATORS DO A Two-Fold JOB . . .!

"FIRST, our Thompson Separator does an amazing job of reconditioning drilling muds by thoroughly removing shales and abrasives from this mud. Second, our separator has a Sample Machine. The Sample Machine gives us an accurate analysis of the progress of our wells by collecting foot-by-foot cuttings. For simplicity and economy alone, we feel the Sample Machine is one of the best methods yet devised for obtaining true samples."

Thompson SHALE SEPARATORS & SAMPLE MACHINES

- SELF-MOTIVATED
- RECONDITIONS MUD
- GIVES ACCURATE SAMPLES
- HAS UNLIMITED CAPACITY

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THE JOURNAL'S WEEKLY
Engineering Reference
SECTION

No. 7

PUMPS:

Part 7—Pumping Viscous Liquids

by Gerald L. Farrar
Engineering Editor

THE resistance offered by a fluid to deformation when subjected to a shear stress is known as its **consistency.** If the **consistency** is constant at fixed static pressure and temperature, the term is usually referred to as **viscosity.**

The friction generated by fluid layers sliding across each other is a measure of the viscosity of the substance. As friction increases (with viscosity) heat is generated and power loss is increased. Other effects of viscosity are described below.

Properties of liquids* . . . The ideal liquid for maximum capacity and for maximum efficiences, both mechanical and volumetric, would be of low specific gravity, nonviscous, have zero vapor pressure, and have excellent lubricating properties.

All deviations from this theoretical ideal represent a reduction of pump capacity and efficiency. For example in the handling of highly viscous liquids the pump must be operated rather slowly in order to allow the fluid cylinders to fill completely at each stroke. This reduction of operating speed obviously reduces the volumetric capacity of the pump.

Because of the viscosity of the liquid, there will be very little slippage past the pistons and valves. Also, because of the low operating speed, there will be no lag in the valve action due to inertia of the valves and the entrained liquid. These last two points produce high volumetric efficiency. Because of the viscosity of the liquid there will be a measurable amount of work performed in the moving of the liquid through the fluid cylinders, valves, and passageways. This work is expended and lost in the form of heat which can be measured as the temperature rise in the oil as it passes through the pump.

Of course, this lost work reduces the hydraulic efficiency of the pump. Ordinarily the more viscous petroleum products have good lubricating qualities and this feature tends to increase the mechanical efficiency due to reduction of piston and stuffing-box friction.

The opposite extreme in pumping problems is represented by the handling of liquefied petroleum gases. Because these liquids have very low viscosity, the pump can be operated at high speed which allows a high volumetric capacity. But, because of the high vapor pressures, cavitation is a very serious problem, which requires either reduced pumping speeds or high net positive suction head.

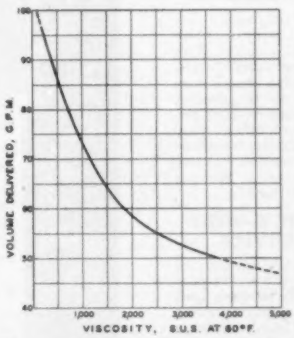

Fig. 1—Effect of viscosity on reciprocating pump efficiency. (From various sources.)

Slippage past the pistons and valves is greater than with more viscous liquids, which result in a lower volumetric efficiency. As a result of the higher operating speed, there is a tendency toward valve lag which reduced the volumetric efficiency. The low viscosity of the liquid tends to increase the hydraulic efficiency of the pump due to low internal friction.

The total lack of lubricating qualities in liquefied petroleum gases causes increased piston and stuffing box friction, thus reducing the mechanical efficiency.

Capacity and efficiency . . . Capacity of a given pump is reduced as viscosity of the pumped fluid increases. For a given size reciprocating pump rated at 100 g.p.m. of water at normal temperatures, capacity begins to decrease at a viscosity of about 100 S.U.s. Decline in capacity as viscosity of pumped liquid increases is shown in Fig. 1. Proportional decreases may be expected for other ratings. Fig. 1 applies **only** for pumps designed and rated for nonviscous fluids such as water. For other pumps, the manufacturer's data should be used.

Specific data for decrease in efficiency are not available. It is thought that efficiency declines in somewhat the same manner as does capacity, but analysis of this point is by no means simple (see above).

Most pump manufacturers are working towards higher capacities and efficiencies without increasing the physical size of the units. The apparent method of achieving this is through higher speeds and higher plunger loads. Effect of viscosity thus becomes doubly important.

*Private communication from John G. Burris, chief engineer, Frank Wheatley Pump & Valve Manufacturer, Tulsa.

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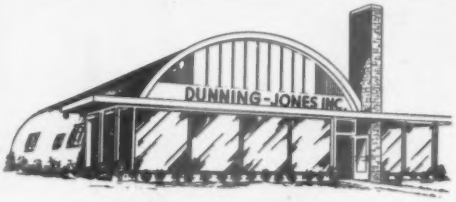

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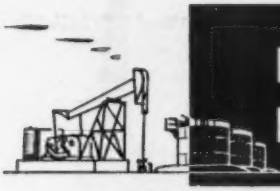

Gas Pipe-Line Formulas

by Ralph F. Nielsen*

IN Engineering Fundamentals No. 481 it was shown that the general formula for the flow of gas in horizontal pipe lines could be obtained from Bernoulli's theorem:

$$\frac{dP}{s} = \frac{u\,du}{g} + dF \qquad (1)$$

when dF is set equal to $2fu^2\,dl/gD$. The symbols have the same significance as previously. To integrate Equation 1 a number of substitutions must be made in terms of quantities usually measured or known:

$$s = \frac{MP}{ZRT} = \frac{29GP}{1{,}544\,ZT} = \frac{0.0187\,GP}{ZT}$$

where:

M = molecular weight of the gas
G = gravity compared to air
R = gas constant
Z = supercompressibility factor
T = flowing temperature in degrees R

$$u = \frac{14.7 \times 144}{520} \times \frac{T}{P} \times \frac{4}{\pi D^2} = \frac{5.18\,qT}{P\,D^2} \text{ and } du = \frac{-5.18\,qT\,dP}{P^2D^2}$$

where:

q = flow rate in standard cubic feet per second

$dF = 2fu^2\,dl/gD = 0.062fu^2\,dl/D$ when $g = 32.2$

Substituting in Equation 1:

$$dP = \frac{-0.0156\,q^2\,GT\,dP}{ZP^2D^4} + \frac{0.031\,fq^2\,TZG\,dl}{P\,D^5} \qquad (2)$$

Examination of Equation 2 shows some terms that are constant and some that are variable. The pressure varies along the line, but this is taken care of if expressions containing P are integrated with respect to P. For the sake of simplicity the flowing temperature is assumed constant and Z is assumed to be an average value Z'. The nature of f for commercial pipe is more or less a function of the Reynolds number, Dus/Z. Since z for a gas does not vary much with pressure and s and u vary in opposite directions with P, the Reynolds number and hence f are nearly constant over the length of conduit. D, q, and G must of course be assumed constant. Multiplying by P and integrating with these assumptions:

$$P_1^2 - P_2^2 = \frac{0.0156\,q^2\,GT}{Z'D^4} \ln \frac{P_1}{P_2} + \frac{0.031\,fq^2\,GT\,lZ'}{D^5} \qquad (3)$$

where P_1 and P_2 are pressures at the two ends of a length l. For practical purposes it is found that the first term on the right is negligible compared to the second. This means that the work of accelerating the gas as the pressure decreases is negligible compared to the frictional work.

If L is the length in miles, d the pipe diameter in inches, Q the daily rate, and p_1 and p_2 the terminal pressures in psia., Equation 3 becomes, on dropping the logarithm term and solving for Q:

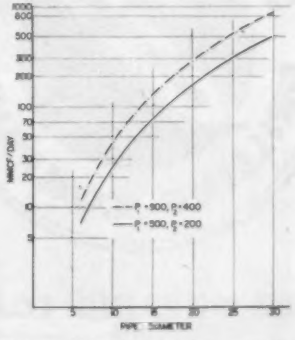

Fig. 1 — Calculated pipe-line capacities. (Line is 50 miles long.)

$$Q = 1{,}370 \left[\frac{(p_1^2 - p_2^2)\,d^5}{Z'\,GT\,Lf} \right]^{1/2} \qquad (4)$$

Several formulas have been proposed which follow from the general formula by expressing f as some function of the pipe diameter. Of these the best known is that due to Weymouth, who proposed the relation $0.008/d^{1/3}$. This gives the formula:

$$Q = 15{,}300 \left[\frac{(p_1^2 - p_2^2)\,d^{16/3}}{Z'\,GTL} \right]^{1/2} \qquad (5)$$

It is apparent from this formula and practical considerations that the capacity of a line is largely dependent on the diameter. The maximum output pressure from the compressor is usually between 500 and 1,000 psi. Little capacity would be gained if p_2, the station intake pressure, was small compared to p_1. Fig. 1 shows capacities in standard cubic feet per day as calculated by Weymouth's formula for a 0.6°-gravity gas at a flowing temperature of 60° F., with 50 miles between compressor stations. Capacity is inversely proportional to the square root of the spacing of compressor stations.

Drew and Genereaux suggest expressing f in terms of Reynolds number: $f = 0.163\,(2d/QG)^{0.15}$.

Substitution in Equation 4 and solving for Q gives:

$$Q = 6{,}550 \left[\frac{(p_1^2 - p_2^2)\,d^{4.81}}{Z'\,G^{0.85}\,TLz^{0.15}} \right]^{0.541} \qquad (6)$$

where z is in pounds per foot per second.

Equation 6, (essentially the Clark formula[2]), has been reported to fit actual observations better than Weymouth's formula at high pressures. For comparison, if $p_1 = 900$, $p_2 = 400$, $d = 24$, $Z' = 1$, $G = 0.6$, $T = 520$, $L = 50$, $z = 0.0000067$, the Clark formula gives $Q = 520$ million as compared with 475 million by Weymouth's formula.

References

1. Johnson and Berwald, "Flow and Natural Gas Through High-Pressure Transmission Lines," Bureau of Mines Monograph 6.

2. "High-Pressure Pipe-Line Research," Clark Brothers Co.

*Associate professor, Petroleum and Natural Gas Engineering, Pennsylvania State College.

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Doghouse Is Built Into Drilling Rig

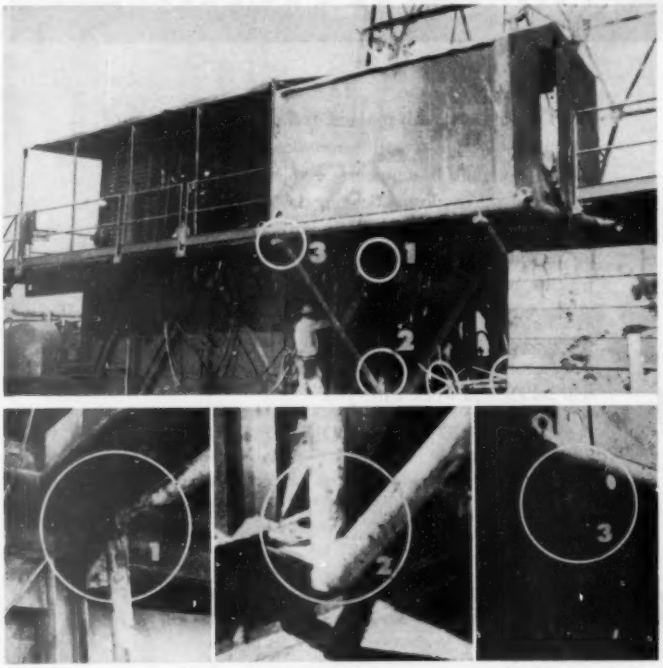
HERE is a support which removes possibility of trucks hitting the vertical posts of the doghouse on a drilling rig, which might cause their failure. Most importantly, the arrangement gives additional close-in working room.

Doghouses built of steel and mounted on conventional skid bases may be used with these newer supports as well as with older types. Previous design of the supporting structure required four posts with top sills and braces, including provisions for altering height of the structure to conform to variations in height of the derrick floor.

The newer-type supporting structure is built as an integral part of the derrick substructure, but easily disconnected when moving. Each structure is designed to accommodate the standard doghouse with skid-type bases, requiring only two "knee braces" which are attached to sockets on the derrick substructure (Fig. 1). The end of the top arm of the brace is formed to an angle of 90° for entering a pocket, or sleeve welded to the top sill of the derrick substructure. The lower end of the leg is fitted with lug which attaches to a clip welded to the bottom sill of the derrick substructure (Fig. 2). This joint is held in position with a pin or machine bolt.

Saddles are attached near the outer end of the horizontal arm of the knee brace so the doghouse skid rails fit into them when the doghouse is lowered into position (Fig. 3). The catwalk of the derrick floor extends outward from the rig to include enough of the doghouse to permit installation of an additional door in the side nearest the driller's position.

This type of support allows the space below the doghouse to be utilized for drilling-cable spools or control wheels of the blowout preventer. Trucks may be driven partially beneath the doghouse without striking the diagonal support, while with the former supporting structure caution was necessary when placing trucks near this side of the derrick.



1—Top inside connection of support to substructure. 2—Base connection of support. 3—Top outside of support has saddles in which doghouse skids rest. Doghouse rests on diagonal supports attached to side of derrick substructure.

Explosion Releaser

WHEN starting larger gas engines, occasionally the exhaust system may become charged with an explosive mixture of air and fuel, which results in an explosion in the system. Engineers for one company have installed a device in the gas-engine exhaust system of a pipe-line pump station which releases explosion forces without damage to the muffler and other parts of the exhaust system.

Exhaust lines at the pumping station leave the manifold in a horizontal position extending several feet from the settings where they are attached to a vertical riser which connects with an underground exhaust disposal system. The riser is made in two separate pieces with a joint about 4 ft. above the ground surface. At the top of the lower section a short section of pipe—two sizes larger than the riser itself is welded. The lower end of the upper portion of the riser is fitted with a large flat ring plate made of steel which rests upon the short section of pipe without obstructing the flow of exhaust gases.

The weight of the exhaust pipe keeps the flat plate end resting snugly against the short section of pipe until an explosion occurs. Force of a line explosion lifts the upper portion of the pipe, separating it at the special joint relieving much of the explosion force from other sections of the exhaust system. After relieving pressure in the exhaust system resulting from an explosion, the joint is automatically reseated. All exhaust lines are equipped with copper tubing which leads water into the system for flame quenching and cooling.

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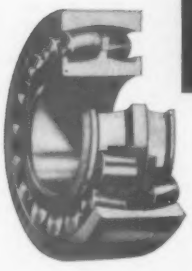

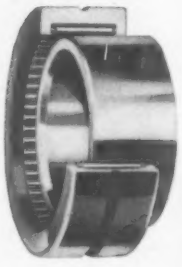

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by W. L. Nelson
Technical Editor

QUESTIONS ON TECHNOLOGY

Sulfur Content of World Crude Oils

Can you supply information on the sulfur content of Middle East crude oils as in your issue of April 7, 1952, regarding gravity?—S. P. C. A.

If the sulfur content of crude oils of the same gravity are compared, the relative amounts of sulfur are about as follows:

East Texas field	low
California	0.75
Average U. S. or Venezuela	1.00
Mississippi	1.50
West Texas	1.75
East Texas low gravity*	2.00
Middle East	3.00

*Talco, Sulphur Bluff, Hawkins, etc.

This relationship can be examined in detail in Table 1.

In actuality, the average gravity of crude produced in each area or country is different, and on such a basis, the approximate relative sulfur contents of the various world crude oils are:

	Average A.P.I.	Per cent sulfur
East Texas field	38.0	0.26
Average United States	*34.0	0.69
California	26.5	1.05
West Texas	*36.0	1.10
Venezuela	25.0	1.45
Mississippi	*26.0	1.60
Middle East	35.0	1.60

*Estimates.

However, the relationships stated above and even Table 1 are too simple to indicate the true situation. Great variations in sulfur content occur in nearly every geographical region. Thus, United States crude oils in the gravity range of 20°-25° A.P.I. have sulfur contents ranging from even 0.10 to as high as 4.17 per cent. Likewise, for 30°-35° A.P.I. crude oils the sulfur content ranges from 0.10 to 2.58. Very much the same variation occurs with other oils.

In addition, the amount of sulfur in each boiling range of material is different for each kind of crude oil. The gasolines in West Texas crude oils are high in sulfur but the gasolines from the other crude oils, including even Middle East crude oils, contain very little sulfur. The kerosines and distillates from California, West Texas, and Panhandle crude oils contain relatively large amounts of sulfur, whereas those from Middle East, Venezuela, and Mississippi crude oil contain lesser amounts of sulfur. finally, exactly the reverse situation arises with respect to the highest boiling or residual stocks. Most of the sulfur in Middle East and Mississippi crude oils appears in the residuums (straightrun).

There is still one other important difference. The crude oils from West Texas and the low-gravity crude oils of East Texas (Talco, Hawkins, Sulphur Bluff, etc.) are "sour," meaning that they contain hydrogen sulfide and are somewhat corrosive even when they have not been heated. The other kinds of crude oils discussed herein are noncorrosive and are classified as "sweet."

TABLE 1—AVERAGE SULFUR CONTENT OF WORLD CRUDE OILS

A.P.I. gravity	Avg. U. S.*	Avg. Venezuela†	Avg. Calif.	Avg. Miss.	Avg. West Texas	Avg. Middle East	Avg. East Texas	Miscellaneous oils — Name	Per cent sulfur
10	....	3.93	2.50	....	....	....	....	Boscan, Venezuela	4.5
11	....	3.40	2.35	....	....	....	....	Lagunillas, Venezuela	2.9
12	2.88	3.02	2.24	....	....	....	....	Brea Olinda, Calif.	2.00
13	2.53	2.72	2.10	3.58	....	....	....	Quitman, Miss.	3.85
14	2.24	2.45	2.00	3.56	....	....	....	Qaiyarah, Iraq.	7.31
15	2.05	2.22	1.91	3.53	....	....	....	Santa Maria, Calif.	4.6
16	1.89	2.03	1.78	3.50	....	....	....	Baxterville, Miss.	2.7
17	1.80	1.89	1.67	3.46	....	....	....	Quiriquire, Venezuela	1.33
18	1.71	1.76	1.57	3.42	....	....	....	McKittrick, Calif.	0.91
19	1.64	1.67	1.48	3.36	....	....	....	Yopales, Venezuela	1.14
20	1.56	1.59	1.40	3.30	3.70	....	4.00	La Rosa, Venezuela	2.12
21	1.50	1.54	1.31	3.21	3.53	....	3.76	Pedernales, Venezuela	2.72
22	1.45	1.50	1.23	3.01	3.15	....	3.52	Temblador, Venezuela	0.76
23	1.39	1.48	1.14	2.73	2.86	....	3.27	Sudr, Egypt	1.93
24	1.34	1.44	1.07	2.28	2.57	....	3.02	Coalinga, Calif.	0.45
25	1.26	1.39	0.98	1.92	2.36	....	2.78	Long Beach, Calif.	1.16
26	1.16	1.32	....	1.62	2.20	....	2.56	Tia Juana, Venezuela	1.55
27	1.08	1.23	....	....	2.02	....	2.35	La Cira, Colombia	0.80
28	1.00	1.12	....	....	1.85	2.72	2.15	Qatif, Saudi Arabia	2.57
29	0.94	1.01	....	....	1.70	2.63	1.97	Mara, Venezuela	2.0
30	0.87	0.92	....	....	1.59	2.51	1.75	Hendrick, West Texas	1.47
31	0.80	0.83	....	....	1.49	2.37	....	Poza Rica, Mexico	1.81
32	0.73	0.75	....	....	1.41	2.20	....	Burgan, Kuwait	2.50
33	0.65	0.65	....	....	1.30	1.97	....	Gach Saran, Iran	1.70
34	0.59	0.58	....	....	1.20	1.78	....	Qatif, Saudi Arabia	1.50
35	0.54	0.50	....	....	1.07	1.59	....	Kirkuk, Iraq	1.90
36	0.49	0.43	....	....	0.93	1.42	0.28	Abqaiq, Saudi Arabia	1.36
37	0.44	0.37	....	....	0.76	1.25	0.27	Kettleman, Calif.	0.32
38	0.39	0.31	....	....	0.53	1.10	0.26	Oficina, Venezuela	0.62
39	0.35	0.27	....	....	0.38	0.98	0.26	San Joaquin, Venezuela	0.22
40	0.31	0.24	....	....	0.30	0.88	0.25	Abell, West Texas	0.27
41	0.28	0.20	....	....	0.27	....	....	Fullerton, West Texas	0.38
42	0.25	0.17	....	....	0.23	....	....	Naft-i-shah, Iran	0.76
43	0.24	0.15	....	....	0.20	....	....	Rodessa, La.	0.28
44	0.22	0.12	....	....	0.18	....	....	Sand Hills, West Texas	0.22
45	0.20	0.11	....	....	0.17	....	....	Santa Rosa, Venezuela	0.10
50	0.13	0.06	....	....	0.15	....	....	Caico Seco, Venezuela	0.13
55	0.08	0.04	....	....	0.12	....	....	El Roble, Venezuela	0.05

*Based on 283 largest fields. †Based on "Venezuelan Crude Oils" by Nelson, Thery, Medina, et al, Ministerio de Minas e Hidrocarburos, Caracas 1951.

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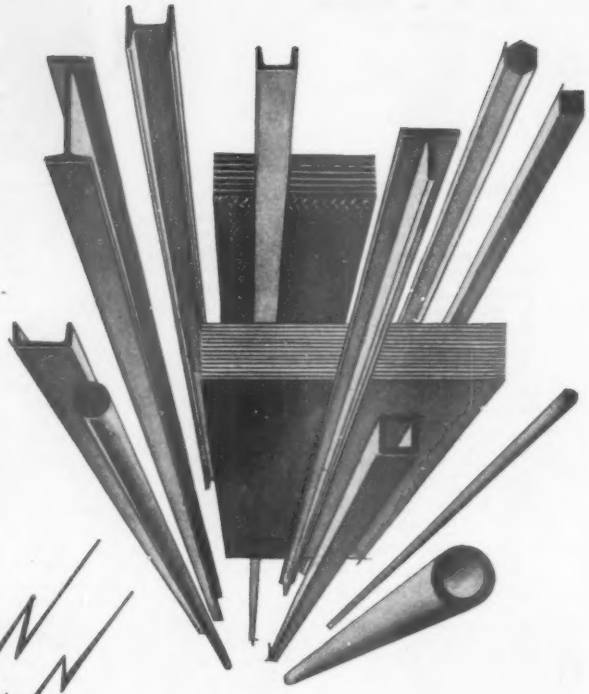

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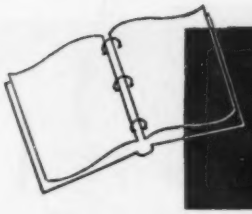

REFINER'S NOTEBOOK

How to Figure Costs . . .

. . . for closed relief-valve discharge system

by S. Chester* and B. W. Jesser†

IN Fig. 1 of No. 122, the Refiner's Notebook, a plot was presented of required thickness of cylindrical shells for different shell diameters and various internal pressures. This figure is to be used in comparing the increase in vessel cost with decrease in cost of discharge piping obtained when the relief valve is set below the design pressure of the vessel.

Within the internal pressure limitations considered in this paper, the A.P.I.-A.S.M.E. formula for calculating the corroded thickness of cylindrical shells:

$$t = \frac{P_D D}{2SE - P_D} \qquad (1)$$

and the corresponding A.S.M.E. formula:

$$t = \frac{P_D D}{2SE - 1.2P_D} \qquad (2)$$

yield for all practical purposes the same results for design temperatures not exceeding 650° F. Beyond this temperature the allowable stresses differ slightly and lead to slightly different results. However, since the design conditions considered herein have been arbitrarily selected, there is no loss in generality if an overall A.P.I.-A.S.M.E. basis is used.

Fig. 1 of No. 122 shows a plot of the required corroded thickness of cylindrical shells for various internal pressures. The chart is based on the A.P.I.-A.S.M.E. formula and is applicable to vessels designed for a temperature not greater than 650° F. and a basic joint efficiency of 80 per cent.

The line on the chart marked minimum thickness represents the A.P.I.-A.S.M.E. code requirement as expressed by the formula:

$$t = \frac{D + 100}{1{,}000} \qquad (3)$$

and is independent of the design temperature.

Points, representing diameters and design pressures of vessels, to the left of the line marked minimum thickness, indicate minimum thickness vessels, whereas, points to the right of the line indicate that the thickness is determined by pressure. Thus, in the case of vessels with design temperature equal to or less than 650° F. and lying to the left of the minimum thickness line in the figure, the design pressure may be increased up to that corresponding to the minimum thickness with no additional cost for the cylindrical shell. The heads may have to be heavied up and reinforcing pads at nozzles added or increased in thickness.

Because of the many variables involved, it is impractical to develop any general economic relation between incremental increases in vessel cost and savings in discharge piping. Nevertheless, experience has indicated that wherever vessels are operating at low pressures and relieving into closed systems, it very definitely pays to put a spread between the set pressure and design pressure. It is not always necessary nor even advisable to raise the design pressure to that corresponding to minimum thickness. Five or ten pounds may sometimes be sufficient. Furthermore, the procedure is not necessarily limited to vessels with design temperatures at or below 650° F. That merely limits the use of Fig. 1 shown in No. 122.

In following the above procedure there is one precaution that must be taken. Due to the fact that the vessels involved have relatively low set pressures, indiscriminate raising of the design pressure and a consequent wide spread between accumulative pressure and set pressure, may result in the back pressure being above the critical pressure. To check this point, the following general formula may be used in order to determine for any given set pressure P_s, what maximum design pressure P_D may be used without exceeding the critical condition:

$$P_D = \frac{1}{(1+n)(1-r)} P_s - \frac{\text{Atm. pressure}}{(1+n)} \qquad (4)$$

where n is a number that depends on the permissible accumulation; for 10 per cent accumulation n = 0.1; for 25 per cent accumulation n = 0.25, etc.; r is the critical pressure ratio (P_s/P_1) crit. that depends on the ratio of specific heats, k.

Assuming a critical ratio of 0.55 and an atmospheric pressure of 14.7, one obtains:

For 10 per cent systems:

$$P_D = 2.02\ P_s - 13.4 \qquad (5)$$

For 25 per cent system:

$$P_D = 1.78\ P_s - 11.8 \qquad (5a)$$

If it is desired to raise the design pressure higher than the figure resulting from Equations 5 or 5a then it is necessary that the relief valve area for the vessel be calculated from the noncritical formula:

$$W = 2404 K_a \sqrt{\left(\frac{P_1}{v_1}\right)\left(\frac{k}{k-1}\right)\left[\left(\frac{P_2}{P_1}\right)^{\frac{2}{k}} - \left(\frac{P_2}{P_1}\right)^{\frac{1+k}{k}}\right]} \qquad (6)$$

*Piping engineer, and †head piping analytical section, M. W. Kellogg Co. From paper presented at 1951 Toronto meeting of A.S.M.E.

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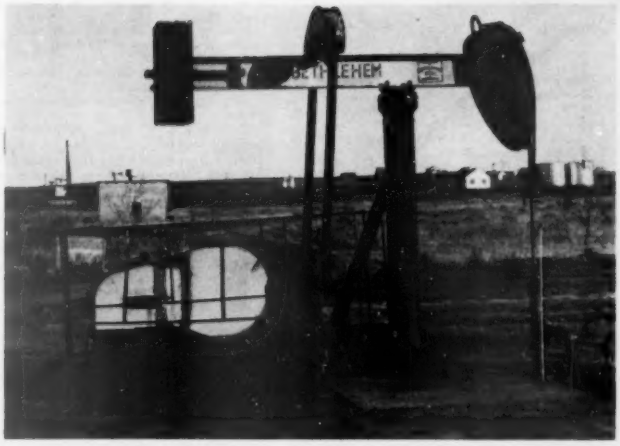


Insulating flanges installed between well and separator or tank battery, in lead line, adjacent to well, eliminates flow of damaging electrical current.

How to Apply Cathodic Protection To Producing Oil Wells

IN discussing cathodic protection as applied to producing wells it should be remembered that the currents are divided into two general categories: First, those occurring inside the casing of the well and second, those outside the casing.

In pumping wells the tubing and the sucker rods are usually made of different metals and if salt water is produced it acts as an electrolyte. Here the same effect is produced as with a dry-cell battery. In the case of the pumping well, the tubing diameter is very small compared to its length and the rod contacts with it in many places, providing a circuit for the flow of current. This current will cause the removal of iron from either the tubing or the rod.

An anode of some metal like magnesium could be placed inside the tubing and connected electrically to it. It would then send a current through the conducting solution to the tubing. If properly located, it would protect the tubing near it against corrosion. Current cannot be sent much farther than two pipe diameters by this method, since the current flows into the pipe at the closest possible point to the anode. Consequently, this method is not generally used.

In practice metals do not have to be recognizably different. This sort of attack is not limited to any particular position in the tubing or well, and can occur anywhere. A familiar example is the so-called "ringworm" corrosion in upset-end tubing, where the structure of the metal has been altered by the upsetting process. There is a normalizing process available which is successful when properly applied. Most steel mills normalize tubing ends and, when properly done, the treatment is successful. Usually pieces are found which have not been properly normalized, resulting in corrosive attack. In a case like this, tubing, which is internally coated with a plastic or similar coating very effectively breaks these paths and overcomes the difficulty better than cathodic protection.

On the outside of the well there is a different situation:

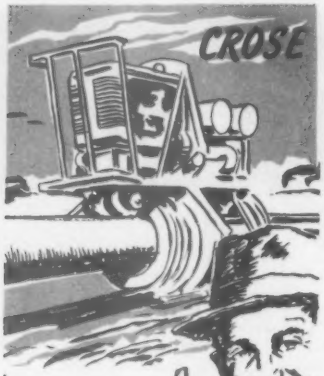
In the case of a producing well connected by means of a pipe to a separator or field tank, there may be a difference in potential between the earth and the well and between the earth and the pipe leading away from the well. A good way to prevent corrosion under these circumstances is to break electrically or insulate the well from the pipe line. In practice, an insulated flange is used at the well. Current flowing in such a system may be measured in the flow line by a sensitive millivolt meter. It is not uncommon to find ½ amp. flowing to an uninsulated well. An inexpensive insulated flange affords excellent protection against corrosion.

Insulating Flanges

Because of the low voltages involved, any insulating material having suitable mechanical strength will normally give the desired results for electrical isolation of the well from lead lines, tanks, or separators.

Although the voltage involved, in the average case, is low, extremely low resistance to ground of the insulated sections may result in heavy flow of current should a short be made accidentally across the insulating flange. Interruption of this current can cause an arc or spark that could ignite any inflammable gas or vapor which might be present, since the current can be as high as several amperes. To avoid accidental shorting of the insulating flange it should be located away from working areas or protected by a "valve-box" type housing.

To serve their purpose, insulating flanges have a twofold job. They must be mechanically strong to withstand line stresses and to maintain a tight joint against line pressure. Also, they must be suitably constructed to completely stop electrical flow between well and lead line. Such flanges are available commercially in various sizes and pressure ratings. The flanges are provided with insulators for both bolts and nuts. Generally the insulating parts for bolts and their nuts consist of cylinders and washers which when installed completely isolate the bolt from the flange proper.



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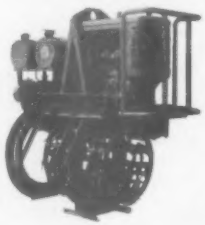

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Pipe-Line Construction

FOLLOWING is a tabulation of pipeline projects which are planned or under construction. Included are crude-oil, products, and natural-gas lines. This list is compiled from surveys made by The Oil and Gas Journal.

Crude-Oil Pipe Lines

American Petroleum Co.—30 miles, 6-in., under way, Village Mills to Arriola Field, Hardin County, Texas. J. R. Stewart, contractor. Completion date 5-15-52.

8 miles, 12-in., authorized, looping Samaria to Earhart, Mich.

15 miles, 12-in., authorized, looping Sylvania, Ohio southward

Cities Service Pipe Line Co.—64 miles, 18-in., planned, Sour Lake, Tex., to Lake Charles, La. Completion date 1-1-53.

19 miles, 8-in., under way, Cushing to Guthrie, Okla. Gragg Const. Co. Completion date 6-1-52.

Continental Pipe Line Co.—105 miles, 8-in., contracted, Rincon to northwest of Sullivan City on to Port Isabel, Tex. Western Const. Co. Completion date 9-30-52.

217 miles, 12-in., authorized, Wichita Falls, Tex., to Ponca City, Okla. Completion date 1952.

Gulf Refining Co.—80 miles, 24-in., proposed, Midland to Colorado City, Tex.

Humble Pipe Line Co.—4, 6, 8, 12-in., proposed, Upton and Reagan counties, Texas.

201 miles, 12-18-in., planned, Hawkins to Baytown, Tex.

Interstate Oil Pipe Line Co.—33 miles, 20-in., under way, Bunkie to Melville, La. Latex Const. of Georgia. Completion date 5-52.

68 miles, 16-in., authorized, Raceland to Anchorage, La. Completion date 10-52.

18 miles, 12-in., authorized, LaRose to Raceland, La. Completion date 10-52.

47 miles, 16-in., authorized, Sunset to Anchorage, La. Completion date 12-52.

21 miles, 12-in., planned, Duck Lake and Bayou Sale to New Iberia, La. 7-31-52.

36 miles, 16-in., planned, Flora to Bunkie La. Completion date 12-31-52.

42 miles, 4-6-10-in., planned, Esperance Pt., Fairview & Lisemore Landing, La., to Cranfield, Miss. Completion date 8-15-52.

Pan American Pipe Line Co.—37 miles, 26-in., planned, Genoa to Texas City, Tex. Completion date 12-52.

40 miles, 14-in., planned, Arden Station in Irion County to Eldorado Station in Schleicher County, Tex. 6-52.

Pasotex Pipe Line Co.—195 miles, 8-in., under way, El Paso to Wink, Tex.

Platte Pipe Line Co.—1,075 miles, 16, 20-in., under way, Worland, Wyo., to Wood River, Ill. Completion date 1952.

573 miles, 16-20-in., under way, Worland, Wyo., to Holdredge, Neb. R. H. Fulton & Co., contractor. A. A. Carrigan, spreadman at Scotts Bluff, Neb.

142 miles, 20-in., under way, Holdredge, Neb., to Kansas State Line, Fulton & Brodie, contractor, J. T. Brodie, spreadman.

Section 7, 274 miles, 20-in., Missouri River to Salisbury, Mo., and Section 8, Salisbury to Mississippi River, under way. O. R. Burden Construction Co. Al Perry, spreadman at Carrolton, Mo.; river crossing field office, Hartford, Ill., Dick Jernigan, spreadsman.

Progress Pacific Pipe Line Co.—900 miles, 20-in., proposed, Permian basin, West Texas to California.

Rancho Pipe Line System.—455 miles, 24-in., authorized, McCamey to Houston, Tex. Completion date late 1952. (Joint project with Sinclair Pipe Line Co., Pan American Pipe Line Co., Tidewater Pipe Line Co., Nantucket Pipe Line Co., Phillips Pipe Line Co., and Ashland Pipe Line Co. with Shell Pipe Line Corp. handling construction and operation.

267 miles, contracted, McCamey to Cedar Valley near Austin, Tex. Anderson Bros. Corp.

190 miles, 24-in., contracted, Austin to Shell's Deer Park Refinery (Houston area).

Roosevelt Oil & Refining Corp.—22 miles, 4 and 6-in., authorized, St. Helens to Norwich, Mich.

Service Pipe Line Co.—29 miles, 10-in., planned, Saunders to Denton, N. M. Completion date 5-52.

33 miles, 16-in., planned, Bowie, Tex., to Drumright, Okla.

30 miles, 6-in., Knox and Haskell counties, Texas.

29 miles, 4, 6, 8-in., proposed, Natrona County, Wyoming.

Shell Pipe Line Corp.—42 miles, 8-in., authorized, Hallettsville to La Grange, Tex. Completion date 7-1-52.

Sinclair Pipe Line Co.—674 miles, 22, 24-in., under way, Drumright, Okla., to East Chicago, Ind. Completion date 1952.

Section 1—150 miles, 24-in., under way. Drumright-Cushing, Okla., area, to Humboldt, Kans. O. R. Burden Construction Co

(Spread 1) 60 miles, 24-in., under way. Caney to Humboldt, Kans. A. B. Haynes, supt., at Chanute, Kans.

(Spread 2) 90 miles, 24-in., under way, Cushing, Okla., to Caney, Kans. Floyd Lewis spreadman at Hominy, Okla.

184 miles, 24-in., under way, Humboldt, Kans., to Salisbury, Missouri. R. H. Fulton & Co., contractor, M. L. Boyd and Jerry Nash, spreadmen.

Sterling Pipe Line System.—83 miles, 12-in., authorized, Sterling, Colo., to connection with Platte Pipe Line at Gurley, Neb. (includes 20 miles, 10-in., main line; 35 miles, 8-in., branch lines.) Joint venture comprising Toronto Pipe Line Co., Shell Pipe Line Corp., and Texas Pipe Line Co.

Sun Pipe Line Co.—99 miles, 4, 6, 8-in., proposed, Scurry County, Tex.

34 miles, 8-in., planned, Jameson to Colorado City, Tex.

13 miles, planned, Cogdell to Brice Island.

Texas Pipe Line Co.—319 miles, 22, 12, 10-in., under way, Louisiana Gulf Coast to Port Arthur, Tex., including 230 miles, 22-in., Houma, La., to Port Arthur, Tex.; 31 miles, 12¾-in., Houma to Cocodrie, La. Houston Contracting Corp. Completion date in summer 1952.

175 miles, 16-in., under way, Corsicana to East Houston. Smith Contracting Corp. Frank Craig, spreadman at Teague, Tex. Completion early summer.

319 miles, 22, 12, 10-in., under way, Louisiana Gulf Coast to Port Arthur, Tex. Houston Contracting Co.

220 miles, 22-in., under way, Houma, La., to Port Arthur, Tex. Houston Contracting Co.

67 miles, 22-in., under way, Holmwood, La., west to Port Arthur, Tex. Houston Contracting Co., E. C. Norris, superintendent at Lake Charles, La.

67 miles, 22-in., under way, Holmwood east to Gueydan, La., and from Morgan City east to Houma. Houston Contracting. W. H Hayes, superintendent, at Jennings, La.

86 miles, 22-in., under way, Gueydan east to Morgan City, La. Houston Contracting. F. A. Silar, superintendent, at Abbeville, La.

65 miles, 6, 8, 10-in., under way, and 30 miles, 12-in., Houma, La., south through Terrebonne Bay vicinity. Houston Contracting. H. L. Leake, superintendent, at Houma.

West Coast Pipeline Co.—986 miles, 20-22-in., planned, Snyder, Tex., to Norwalk, Calif.

West Texas Gulf Pipe Line Co.—471 miles, 26-in., contracted, Colorado City to Wortham, Tex., Wortham to Sour Lake, Tex., 24-in. Completion date 10-52.

114 miles, 20-in., contracted, Wortham to Longview, Tex. Completion date 10-52.

44 miles, 26-in., under way, Glenrose, Tex., area. Anderson Brothers, contractor.

120 miles, 26-in., contracted, East of Abi-

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60 miles, 26-in., contracted, Colorado City to Abilene, Tex. Anderson Bros. Corp.

94 miles, 26-in., contracted, West of Wortham, Tex. Anderson Bros.

Products Pipe Lines

Bell Oil & Gas Co.—150 miles, 6-in., planned, Ardmore to Drumright, Okla. (Includes 114 miles, 8-in., 32 miles, 6-in.) Completion date 6-1-53.

Buckeye Pipe Line Co.—370 miles, 8, 12, 16-in., authorized, Linden, N. J., via Allentown, Pa., to Auburn, Syracuse, Waterloo, and Rochester, N. Y. (Sections divided as follows: 75 miles, 16-in., 218 miles, 12-in., 77 miles, 8-in.). Completion of 16-in., 1952, balance 1953.

Coastal Products Pipe Line Co.—260 miles, 20-in., proposed, Houston to Baton Rouge

Derby Oil Co.—30 miles, 4-in., under way, Wichita to Bell, Kans. Completion date 7-1-52.

Keystone Pipe Line Co.—60 miles, 12-in., proposed, Pt. Breeze, Pa., to Montello, Pa. Completion date 12-31-52.

Ohio Oil Co.—255 miles, 8, 10-in., proposed, East St. Louis, Ill., to Indianapolis.

24 miles, 8-in., authorized, East St. Louis to Wood River, Ill.

214 miles, 12-18-in., planned, Lima to East Sparta and Newark, Ohio.

Phillips Oil Co.—28 miles, 12-in., authorized. Sweeny to Freeport, Tex. Completion date 3-52.

Phillips Pipe Line Co.—42 miles, 10-in., under way, Green Ridge to Villa Ridge, Mo. Mid-States Const. Co. T. H. Edmonds, superintendent at Sedalia, Mo.

68 miles, 12¾-in., under way. Osawatomie westward to Wichita, Kans. Brown Lite Co. R. E. Carriker, spreadman at Osawatomie, Kans.

40 miles, 10-in., through Monteau, Cole, Osage, and Gasconade counties, Missouri, Trojan Const. Co. E. L. Maggard, spreadman at Linn, Mo.

Under way, Paloa, Kans.-Harrisonville, Mo. Smith Contracting Corp.

74 miles, 8-in., under way, looping from Decatur, Ill., to East Chicago, Ind. Somerville Const. Co., contractor.

137 miles, 10-in., authorized, looping from Paola, Kans., to East St. Louis, Ill.

Pioneer Pipe Line Co.—(Continental Pipe Line Co. and Sinclair Pipe Line Co.). 310 miles, 8-in., proposed, Sinclair, Wyo., to Salt Lake City, Utah.

Progress Pacific Pipe Line Co.—900 miles, 10-in., proposed, California to West Texas.

Salt Lake Pipe Line Co.—Proposed, Pasco, Wash., to Puget Sound.

330 miles, 8-in., planned, Salt Lake City, Utah to Boise, Idaho. Completion date 12-1-52.

Shell Oil Co.—565 miles, 8-14-in., planned, Wood River via East Chicago to Detroit; 35 miles, 14-in. Completion date summer of 1952.

Sinclair Pipe Line Co.—10-in., Houston to Baton Rouge; 16-in., Kalamazoo to Detroit; 20-in., Marcus Hook to Bayonne, N. J.; East Chicago to South Bend, Ind.

8-10-in., planned, Sinco to Port Arthur, Tex.

Standard Oil Co. (Ind.).—316 miles, 12-in., proposed, Sugar Creek refinery to Dubuque, Iowa. Completion date 1-1-53.

122 miles, 8-in., under way, Neodesha, Kans., to Belton, Mo. Bills & Tuoth Construction Co., Carl Bills, superintendent, at Armory Building, Neodesha. Completion date 1952.

Standard Oil Co. (Ohio).—17 miles, 6-in., authorized, Toledo to West Toledo, Ohio.

Sun Pipe Line Co.—110 miles, 8-in., under way, Fostoria to Hudson, Ohio.

Susquehanna Pipe Line Co.—123 miles, 6, 8-in., proposed, Fostoria to Randolph, Ohio.

Tuscarora Oil Co.—74 miles, 6-10-12-in., under way, Allentown to Midland, Pa.

United States Pipe Line Co.—1,000 miles, proposed, Gulf Coast via Memphis, Nashville, Tenn., Lexington, and Paducah, Ky., to Cincinnati, Ohio.

Natural-Gas Pipe Lines

Algonquin Gas Transmission Co.—140

miles, 24-26-in., under way, New Jersey to Connecticut River near New Haven. Williams Brothers, contractor, Robert L. Buck, project manager, Danbury, Conn. Spreadmen: Thelmer Davis, Waterbury, Conn., O. L. Martin, Sloatsburg, N. Y., O. R. Mitchell, Danville, N. J. Completion date 8-1-52.

253 miles, 24-26-in., under way, Lambertville, N. J., to Boston area. Williams Bros., contractor. Completion date 9-1-52.

270 miles, under way, New Jersey, Connecticut, Rhode Island, and Massachusetts. Completion date 9-1-52.

Allied Gas Co.—24 miles, 6⅝-in., proposed, McLean to Champaign County, Illinois.

Arkansas-Missouri Power Co.—140 miles, 2-10-in. planned, Arkansas and Missouri.

Associated Natural Gas Co.—88 miles, authorized, Missouri.

Carolina Natural Gas Corp.—185 miles, 2-12-in., proposed, lateral lines off Transcontinental in North and South Carolina.

Cities Service Gas Co.—179 miles, 4-30-in., gathering system in vicinity of Ulysses, Kans. Vaughn & Taylor Const. Co., Inc. D. D. Vaughn, spreadman, Ulysses.

21 miles, 26-in., proposed, Franklin and Anderson counties, Kansas.

15 miles, 20-in., Craig County, Oklahoma, to Lawrence County, Missouri.

Coast Counties Gas & Electric Co.—40 miles, 3, 4, and 8-in., planned. Coast and Valley region, California.

Colorado Interstate Gas Co.—250 miles, 20-in., under way, Kit Carson, Colo., to Amarillo, Tex. R. H. Fulton & Co., contractor. Jerry Nash, spreadman at Lamar, Colo.

16 miles, 4-in., Pueblo County to Fowler, Colo.

Commonwealth Natural Gas Corp.—537 miles, 20-in., proposed, West Bend, Ky., to Norfolk, Va.

Dow Chemical Co.—70 miles, various sizes. Midland, Saginaw, and Bay City, Mich. Mahoney Contracting Co., contractor. Ralph Bucher, spreadman at Midland.

East Tennessee Natural Gas Co.—172 miles, 22-in., authorized, Greenbrier to Oak Ridge, Tenn.

100 miles, 16-in., proposed, Knoxville to Kingsport, Tenn.

El Paso Natural Gas Co.—133 miles, 30-in., proposed, looping along main line in Texas, New Mexico, Arizona.

36 miles, 24-in., proposed, looping from Kingman to Franconia, Ariz.

Equitable Gas Co.—17 miles, 16-in., under way, near Pittsburgh, H. L. Gentry Const. Co., contractor. Lavern Curtis, spreadman at Sewickley, Pa.

Frederick Gas Co.—26 miles, 4-in., planned, Redlands to Frederick, Md.

Georgia Gas Co.—32 miles, 4½-in., proposed, Bogart to Gainesville, Ga.

Glacier Gas Co.—285 miles, 20-in., proposed, Kalispell, Mont., to Spokane, Wash.

120 miles, 16-in., proposed, Spokane to Hanford, Wash.

91 miles, 8⅝-in., proposed, Spokane to Lewiston, Idaho.

130 miles, 12¾-in., proposed, Spokane to International boundary at Trail, British Columbia.

Grand Valley Pipe Line Co.—105 miles, 8-10-in., planned, Piceance Creek field to Rifle on to Grand Junction, Colo.

Gulf Interstate Gas Co.—1,000 miles, 30-in., planned, Gulf Coast to North Kentucky.

Home Gas Co.—32 miles, 12-in. authorized, Breesport to Union Center, N. Y.

17 miles, 12-in., proposed, loops from Hancock to Sanford, N. Y.

Hope Natural Gas Co.—33 miles, 8-10-12-in., planned, Wyoming County, West Virginia, south to Cuchanan County, Virginia.

Iowa-Illinois Gas & Electric Co.—41 miles, 10-in., authorized, Washington County to Cedar Rapids, Iowa.

¾ to 6-in., under way, Davenport, Iowa, and Moline, Ill. C. E. Wilson Const. Co.

Kansas-Nebraska Natural Gas Co., Inc.—179 miles, proposed, Kansas and Nebraska.

20 miles, 16-12-in., planned, Hastings to Grand Island, Neb. Completed date 1952.

18 miles, 6-8-in., planned, McCook Neb., south. Completion date 1952.

54 miles, 4-6-in., planned, Neligh to Hartington, Neb. Completion date 1953.

49 miles, 10-in., planned, Ogallala to North Platte, Neb. Completion date 1952.

20 miles, 12-in., planned, Atwood to near Oakley, Kans. Completion date 1952.

Kansas Power & Light Co.—27 miles, 20-in., authorized. Pratt, Kans., to Calista compressor station.

28 miles, 12-16-in., planned, north of Kansas to Meade County Gas Field.

Lake Shore Pipe Line Co.—45 miles, 10¾-in., authorized, northwesterly from T.G.T. system near Meadville, Pa., to Ashtabula, Ohio.

Lone Star Gas Co.—100 miles, proposed, storage fields to the Dallas-Fort Worth area. 35 miles, 12-in., proposed, southeastern Schleicher County.

Manufacturers Gas Light & Heat Co.—40 miles, proposed, Allegheny, Washington, and Beaver counties, Pennsylvania.

Michigan Gas Storage Co.—93 miles, 16, 22, 24-in., under way, Laingsburg to near Pontiac and Mount Clemens, Mich. (Includes 17 miles of lateral lines.) Mahoney Contractor. Completion date 6-52.

30 miles, 26-in., authorized, looping between Laingsburg and Mount Pleasant Junction, Mich.

Michigan Gas Utilities Co.—77 miles, under way, Sturgis, Hillsdale, and Coldwater, Mich. (22.7 miles, Marshall south to Coldwater; 20 miles, Coldwater easterly to Hillsdale; 22.5 miles, Hillsdale to Sturgis, 11 miles, Hillsdale to Jonesville.) Somerville Const., contractor, Jim Godwin at Coldwater.

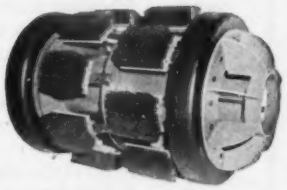
MidSouth Gas Co.—240 miles, proposed. Greene, Poinsett, Crittenden, St. Francis, Lee, Phillips, Monroe, Woodruff, and Cross counties, Arkansas.

Minneapolis Light & Power Co.—20 miles, 30-in., under way, Minneapolis, Williams Bros., contractor. F. W. Caldwell, spreadman.

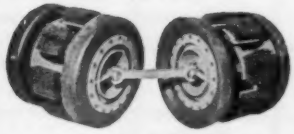
Mississippi River Fuel Corp.—98 miles, 16- and 18-in., authorized, feeder line from Lin-

THE PIG WITH THE POKE — CLEANS PIPE LINES

MORE CUBIC FEET PER DAY...
THROUGH NATURAL GAS LINES
CLEANED by WILLIAMSON PIGS

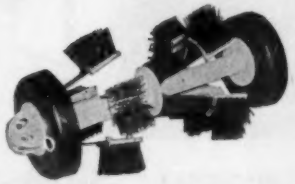


GP-2 16"-30"
Similar design 10" to 14" sizes. Will traverse all standard pipe-line gate valves and field bends of approx. 12 ft. radius.



GP-3 18"-30"
Similar design 10" to 16" sizes. Will traverse long-radius welding ells up to 90° lengths. Also through port and many conventional gate valves.

WC-12 6"-14"
Will traverse all standard pipe-line gate valves and field bends.



Other designs for sizes smaller than 6"

REPRESENTATIVES

H. E. Davis, Los Angeles 15, Calif. — James S. Kone Co., Amarillo, Texas — Keyes Tank Co., Provo, Utah — Keyes Tank & Supply Co., Casper, Wyoming

Canadian Equipment Sales & Service Co., Ltd., Edmonton, Calgary, Toronto, Canada

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TULSA 9, OKLAHOMA

coln Parish, Louisiana, to Waskom field, Harrison County, Texas.

40 miles, 18-in., authorized, Dubach to Perryville, La.

Missouri Central Gas Co.—25 miles, 6-in., contracted, Moberly to Macon, Mo. L. R. Young Const. Co.

Montana Power Co.—52 miles, 16-in., authorized, Canada-Montana border to Cut Bank, Mont.

Morganfield Natural Gas Co.—31 miles, 4-6-in., proposed, through Sturgis, Providence, Clay, Diamond, Wheatcroft, and Sullivan, Ky.

National Utilities Co. of Michigan.—76.7 miles, 20-in., proposed, South Central Michigan. (22 miles from near Marshall south to Coldwater; 30 miles east to Hillsdale; 22 miles southwest to Sturgis; 5 miles from Hillsdale to Jonesville and 8 miles west to Union City.)

Nevada Natural Gas Pipe Line Co.—114 miles, 10-in., proposed, Topock, Ariz., to Las Vegas, Nev.

New River Gas Co.—50 miles, planned, Summers to Monroe counties, West Virginia to Narrows and Dublin, W. Va.

New York State Natural Gas Corp.—104 miles, 14, 16, 20-in., authorized, looping on Westmoreland, Armstrong, and Tioga counties, Pennsylvania. (Includes 17 miles, 16-in., in Potter County, Pennsylvania, and 21 miles 14-in., replacement in Line No. 507, New York.)

12 miles, 20-in., under way, looping at Zelienople, Penn. Williams-Austin Co. Ralph Gaddy, supt. 5-15-52.

52 miles, 16-in., contracted, Utica to Amsterdam, N. Y. (to begin at completion of Zelienople). Williams Austin. Ralph Gaddy, supt. Completion in 90 days.

20 miles, 20-in., begin 5-1, Cayuta Gate to Ithaca, N. Y. Williams-Austin Co. Howard Bauer, supt. Completion date 6-30-52.

30 miles, 20-in., contracted, Angelica to Rossburg, N. Y. (begin at completion of Cayuta-Ithaca). Williams-Austin. Howard Bauer, supt. Completion in 45 days.

17 miles, 16-in., contracted, Colesburg Junction to Sabinsville, Pa. (begin at completion of Angelica job). Williams-Austin. Howard Bauer, supt.

21 miles, Columbiana and Stark counties, Ohio.

Niagara Mohawk Power Corp.—55 miles, 10-in., Fulton to Watertown, N. Y.; Williams-Austin Co., contractor, Howard Bauer, supt. Completion date 9-52.

Northeastern Gas Transmission Co.—221 miles, 20-24-in., authorized, New Hampshire, Massachusetts, and Connecticut.

Northeastern Gas Co.—411 miles, proposed, New England towns.

Northern Natural Gas Co.—580 miles, proposed, Kansas, Texas, Oklahoma, and Nebraska loops.

210 miles, 26-in., proposed, five loops in Texas-Oklahoma area, two in Kansas, and two in Nebraska.

400 miles, 24-in., proposed, Emerson, Manitoba south to Red River Valley through Fergus Falls on to St. Paul, Minn.

Northern Indiana Fuel & Light Co.—33 miles, 8-in., proposed, Edgerton to Auburn, Ind.

Northwest Natural Gas Co.—750 miles, planned, Washington, Oregon, and Idaho.

373 miles, 24-in., proposed, Eastport, Idaho, to Monroe, Wash.

79 miles, 18-in., proposed, Monroe to International boundary near Lynden, Wash.

29 miles, 22-in., proposed, Monroe to near Seattle, Wash.

164 miles, 20-in., proposed, Seattle to Portland, Ore.

Ohio Fuel Gas Co.—31 miles, 20-in. authorized, Licking County to Richland County, Ohio.

22 miles, 16-in., authorized, Dayton, Troy, Piqua, and Sidney, Ohio.

23 miles, 16-20-in., authorized, Wellington to Elyria, Ohio; 16 miles, 20-in., authorized, Benton Station to Crawford Station. 18 miles, 20-in., Crawford Station to near Columbus. 16 miles, 16-in., authorized, Berlin to Sandusky, Ohio.

74 miles, 3 to 20-in., authorized, Hocking, Knox, and Ashland counties, Ohio.

47 miles, 20-in., authorized, Benton Township, Hocking County, to Columbus, Ohio.

61 miles, authorized, northern and southwestern Ohio.

33 miles, 20-in., proposed, Jefferson to Seneca, Ohio.

Pacific Gas & Electric Co.—44 miles, 8-in. under way, Salinas to King City, Calif. W. M. Lyles and company crews. Completion date 6-10-52.

141 miles, 34-in., proposed, parallel sections along Topock-Milpitas line.

10 miles, 10-12-in., authorized, Monterey to Fort Ord to Castroville; 12 miles, 16-in., Napa Wye to Shellville; 6 miles, 12-in., Cotati to Santa Rosa, Calif.

Pacific Northwest Pipeline Corp.—26-in. Alberta fields through to Pincher Creek, Spokane, Hanford, Vancouver, and Portland.

Panhandle Eastern Pipe Line Co.—70 miles, 24-26-in., under way, looping from Sneed, Tex., to Emporia, Kans.

174 miles, 30 and 26-in., contracted. Tuscola, Ill., eastward—looping present system; R. A. Conyes, contractor.

44 miles, 26-in., Edgerton, Mich., Anderson Bros.

22 miles, 30-in., looping in Tuscola, Ill.

45 miles, 30-in., looping in Montezuma, Ind.

63 miles, 30-in., looping in Zionsville, Ind.

Pennsylvanian Gas Co.—52 miles, 12-in., between Warren and Erie, Pa. Section 1—27 miles, under way and contracted by Harford Bros. Section 2—25 miles.

Peoples Natural Gas Co.—25 miles, proposed, Cambria and Blair counties, Pennsylvania.

Permian Basin Pipeline Co.—314 miles, 20-30-in., proposed, Permian Basin area to eastern New Mexico.

139 miles, planned, Upton County, Texas, to Lea County, New Mexico.

76 miles, planned, Lea County to Roosevelt County, New Mexico.

169 miles, planned, Roosevelt County, New Mexico, to Carson County, Texas.

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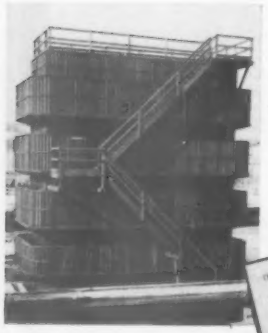

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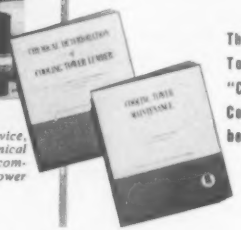

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Phillips Petroleum Co.—118 miles, 3-22-in., under way, Sherman and Hansford counties, Texas, gas-gathering system; Vaughn & Taylor Construction Co., Inc., Dumas, Tex., J. F. Crawford, spreadman at Texhoma, Okla.

Prince George's Gas Corp.—30 miles, 22-in., authorized, between Chillum and Rockville, Md.

Public Service Co. of Colorado.—95 miles, proposed, Douglas Creek and other gas fields to Grand Junction, Colo., area.

Public Service Co. of North Carolina.—33 miles, 10-in., authorized, Burlington to Chapel Hill, N. C.

16 miles, 8-in., authorized, Chapel Hill to Raleigh, N. C., completion date 7-1-52.

29 miles, 4-in., authorized, Statesville to Kanapolis, N. C., completion date 7-1-52.

83 miles, 8-in., authorized, Kings Mountain to Asheville, N. C., completion date 3-1-53.

Rockland Light & Power Co.—22 miles, 8-in., proposed, Orangetown to Tompkins Cove, N. Y.

South Georgia Natural Gas Co.—339 miles. 2-12-in., proposed, Florida and Georgia.

Southern California Gas Co.—35 miles, planned, Antelope Valley, California.

Southern California Gas Co. and Southern Counties Gas Co. of California.—45 miles, 30 in., proposed, looping on line from Arizona border to Los Angeles.

81 miles, 30-in., proposed, Whitewater to Desert Center, Calif.

Southern Natural Gas Co.—21 miles, 24-in., authorized, Perryville Station La., to Boeuf River.

14 miles, 24-in., authorized, Onward Station, Miss., to Big Sunflower River.

14 miles, 14-in., authorized, Perryville Station, La., to Wilhite Gate.

375 miles, 24-in., planned, Gwinville, Miss., to Atlanta, Ga.

169 miles, proposed loops, Ouachita Parish, Louisiana, to Augusta, Ga.; 20 miles in Ouachita Parish, 33 miles in Ouachita and West Carroll parishes; 7 miles, Sharkey County, Mississippi; and 108 miles, 14-in., Bass Junction to Augusta, Ga.

Southern Union Gas Co.—21 miles, 20-in., authorized, Albuquerque, N. M.

27 miles, 10-in., authorized, Lea and Eddy counties, New Mexico.

30 miles, 12-20-in., contracted, San Juan County, New Mexico. R. H. Fulton & Co.

Southwest Gas Corp., Ltd.—26 miles, proposed, from P.G.&E. line to Victorville, Calif.

Tennessee Gas Transmission Co.—591 miles, 24-30-in., proposed, looping along present system (consisting of 323 miles of 30-in.; 167 miles of 26-in.; 101 miles of 24-in.)

420 miles, 30-in., Texas, Louisiana, Arkansas, Mississippi, Tennessee, and Kentucky.

101 miles, 26-in., Kentucky and Ohio.

304 miles, 24-in., proposed, Mercer, Pa., to Utica, N. Y.

250 miles, miscellaneous laterals.

Texas Eastern Transmission Corp.—791 miles, 30-in., under way, Kosciusko, Miss., to Connellsville, Pa.

Section 8, 77 miles, 30-in., under way, Portsmouth to Amesville, Ohio. Anderson Bros. Corp.

Section 9, 74 miles, 30-in., under way, Amesville to Ohio-West Virginia river crossing. Anderson Bros. Corp.

Section 10, 66 miles, 30-in., under way, Ohio River to Connellsville, Pa. Anderson Bros Corp.

315 miles, 24-in., proposed, Provident City, Tex., to Castor, La.

Texas Gas Transmission Corp.—408 miles, 26-in., proposed, looping from Bastrop to Hardinsburg, Ky.

223 miles, 26-in., proposed, Bastrop, La., to Covington, Tenn.

47 miles, 26-in., proposed, northeastward from Covington.

49 miles, 26-in., proposed, northeastward from Kenton, Tenn.

45 miles, 26-in., proposed, northeastward from Calvert City, Ky.

25 miles, 26-in. proposed, northeastward from Slaughters, Ky.

19 miles, 26-in., proposed, southwestward from Jeffersontown, Ky.

180 miles, 26-in., authorized, Acadia Parish to connection with existing facilities in Morehouse Parish.

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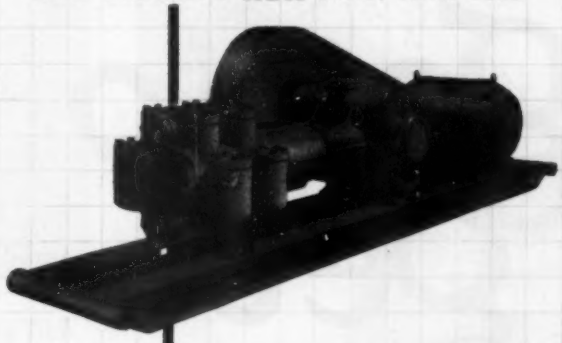

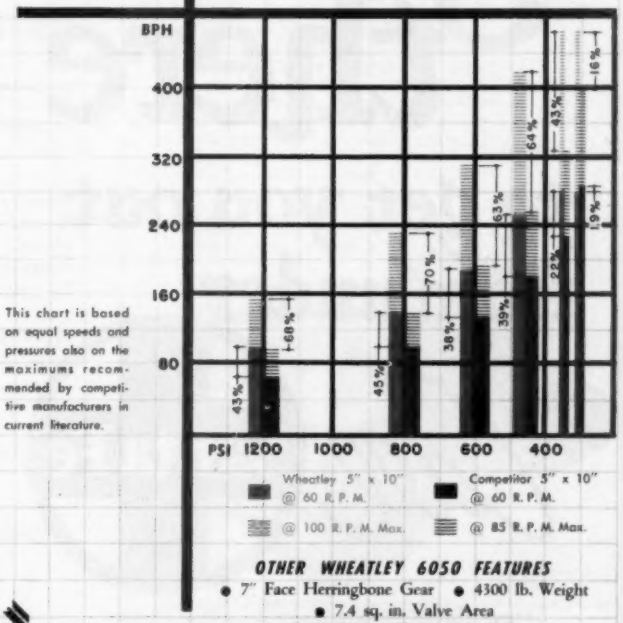

This chart is based on equal speeds and pressures also on the maximums recommended by competitive manufacturers in current literature.

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35 miles, 12-in., authorized, Slaughters, Ky., to Evansville, Ind.

195 miles, 26-in., proposed, Gulf Coast region to southwestern Louisiana.

560 miles, 26-in., proposed, Louisiana and Kentucky.

Texas-Ohio Gas Co.—1,350 miles, 30-in., proposed, Hidalgo County, Texas, through Arkansas, Mississippi, Tennessee, and Kentucky on to Spencer, W. Va. Completion date 6-30-53.

Union Oil Co. of California.—40 miles, 8-10-in., planned, San Joaquin Valley and Los Angeles basin.

United Fuel Gas Co.—32 miles, 26-in., under way, Lanham to Broad Run, W. Va. H. L. Gentry Construction Co., contractor. Frank Morris, spreadman at Charleston, W. Va.

United Gas Pipe Line Corp.—315 miles, 24-30-in., under way, Agua Dulce to near Goodrich, Tex. Oklahoma Contracting Co., contractor. Panama Shiflett, spreadman, El Campo, Tex.; Ray Law, spreadman, Victoria, Tex.

510 miles, 20 to 30-in., under way, Agua Dulce, Tex., to Monroe, La. River Const. Corp., contractor.

Spread 1, 51 miles, 30-in., from Pearl River north and south of Jackson, Miss. Red Tatom, superintendent at Jackson.

Spread 2, 45 miles, 30-in., McComb to Pearl River south of Jackson. Merle Tatom, superintendent at Hazelhurst.

Spread 3, 30 miles, 30-in., Kosciusko south toward Jackson. Jimmy Reed, superintendent at Kosciusko.

Spread 4, 29 miles, 12-in., Lafayette to Jeanerette, La. Roy Earnhart, spreadman at Jeanerette.

124 miles, Sterlington compressor station near Monroe to Jackson, Miss.

23 miles, 8-12-16-in., South Louisiana facilities.

53 miles, 24-in., authorized, Texas.

36 miles, proposed, offshore from Ingleside to near Refugio, Tex.

All contracted by River Const. Corp., a joint venture including Oklahoma Contracting Co.; J. Ray McDermott & Co., Inc., and Morrison-Knudson. Inspection by Brown & Root, Inc.

Virginia Natural Gas Co.—153 miles, Buckingham to Richmond and Portsmouth, Va.

Western Kentucky Gas Co.—2 to 4-in., under way, additions to present system; Modern Welding Co., Inc., contractor.

Western Pipe Lines.—1,300 miles, 22-in., planned, southern Alberta to Duluth, Minn.

West Texas Gas Co.—27 miles, 10-in., authorized, Lubbock to Abernathy, Tex.

Wilcox Trend Pipe Line Co. (Harry Bass Drlg. Co.)—150 miles, various up to 20-in., planned, gathering system for delivery to proposed Texas Eastern terminal at Provident City, Tex.

Foreign Crude-Oil Pipe Lines—Planned and Under Way

Alberta-Vancouver Oil Pipe Line Co.—(Brokaw, Dixon, McKee).—972 miles, 16-in. proposed, Edmonton via Pincher Creek Alta., Idaho and Washington states to Vancouver, B. C.

Cia. de Petroleo Ganso Azul, Ltd.—48 miles, 4-in., planned, Ganso Azul field to Pucalpa on upper Ucayali River, Peru.

Condor.—90 miles, 12-in., under way, Genos to Rho, near Milan, Italy. Soc. Ital Condotte Acqua Montubi, contractor. Completion date 7-31-52.

Creole Petroleum Corp.—143 miles, 26-in., under way, Ule (State of Zulia) to Amuay (State of Falcon). Williams Bros. de Venezuela, S. A., contractor of overland sections. Charles Williams, manager; Marvin Jones, general superintendent, Maracaibo. McWilliams, Gahagan, and Anderson Bros., contractors of water crossings. Completion date March 1953.

25 miles, 34-in., authorized. Lagunillas to La Salina (State of Zulia). Completion date April 1953.

Direccion General de Yacimientos Petroliferos Fiscales.—400 miles, under way, Plaza Huincul to Bahia Blanca, Argentina.

Interprovincial Pipe Line Co.—100 miles, 16-in., contracted, Regina, Sask., to Gretna, Man., Canada. Anderson International Contractors, Ltd.

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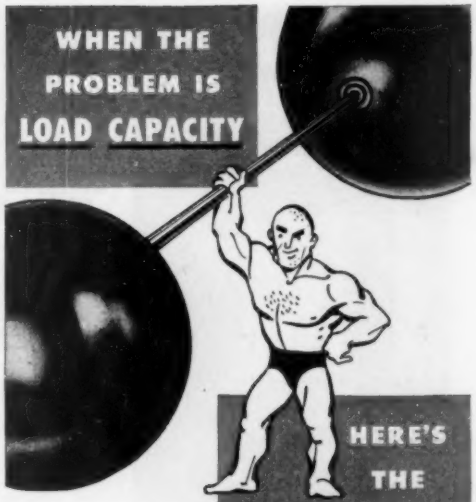

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Iraq Government.—135 miles, 12-in., proposed, from Iraq Petroleum Co. at Baija to Baghdad, Iraq. Construction 1952, M. W Kellogg, contractor.

72 miles, 12¾-in., Zubair to Fao. Arabian Bechtel Co., contractor.

Mene Grande Oil Co.—30 miles, 26-in., under way, Anaco to Puerto La Cruz. Chicago Bridge & Iron Co., contractor.

32 miles, 26-in., authorized, Anaco to Puerto La Cruz.

Middle East Pipelines, Ltd.—800 miles, 34-35-in., planned, Iran to a Levantine port.

Petroleos Mexicanos.—145 miles, 12-in. considered, 18 de Marzo field via Reynosa to Monterrey, Mexico.

100 miles, planned, Isthmus of Tehuantepec, Jose Colomo to El Plan field, Minatitlan.

Socony-Vacuum Oil Co., Inc.—20 miles, 8-10-in., under way, Hutchinson, Kans. Brown-Lite Contractor.

Spitz & O'Berine.—264 miles, 24-in., under way, Capetown to Tarrytown, South Africa. J., C. Spitzexplari, spreadman at Capetown.

Texas Petroleum Co.—60 miles, 4-6-in. under way, Pto. Nino to La Dorada.

Trans-Mountain Oil Pipe Line Co.—639 miles, 24-in., proposed, Edmonton, Alta., to Vancouver, B. C. Canadian Bechtel, Ltd., engineers.

221 miles, 24-in., contracted, center section of line, Mannix, Ltd.

472 miles, 24-in., contracted, Western section of line, Comstock Midwestern, Ltd. Const., contractor. Jim Godwin at Coldwater.

Foreign Products Pipe Lines—Planned and Under Way

Colombia Ministry of Petroleum.—90 miles 6-in., planned, Puerto Berrio to La Dorada Colombia.

113 miles, 6-in., contracted, Puerto Berrio to Acededo near Medellin, Colombia. Carolina Construction Co.

75 miles, 4-in., planned, Buena Ventura to Cali, Colombia.

Empresa de Ferrocarriles Ecuatorianos.—50 miles, 6-in., contracted, Guayaquil to Palmira, Ecuador. J. A. Jones, contractor; C.R.C. Engineering Co., engineers.

Estrada de Ferro Santos a Jundiai.—32 miles, 18-in., under way, Santos to Sao Paulo, Brazil ((fuel oil line); Techint, contractor. Completion date 12-51.

Governments of Southern Rhodesia and Portuguese East Africa.—200 miles, considered, Beria, Portuguese Mozambique to Umtali, Southern Rhodesia.

Imperial Oil Co., Ltd.—170 miles, 10-12-in., under way, Hamilton to Toronto, Ont., Canada, Comstock-Midwestern, Ltd., contractor. Completion date July 1952.

Petrocongo (Sub. Cie. Financiere Belge des Petroles, S.A.).—225 miles, considered, Ango-Ango to Leopoldville, Belgian Congo.

Societe des Transports Petroliers par Pipe Line.—140 miles, 10-in., under way, Le Havre to Paris, Fance. Entrepose, contractor. Completion date 1952.

State of Cundinamarca, Colombia.—120 miles, 6-in., Puerto Salgar to Bogota, Colombia; Williams Brothers Co.; David Louthen, manager, Bogota.

Trans-Northern Pipe Line Co.—440 miles, under way, Hamilton, Ont., to Toronto, Ont., to Montreal, Que., Canada.

Foreign Natural-Gas Pipe Lines—Planned and Under Way

Azienda Generale Italiana Petroli.—110 miles, 12-14-16-in., planned, Cortemaggiore to Genoa.

145 miles, 14-16-in., under way, Cortemaggorie to Torino. Completion date 1951.

Canadian Delhi Oil Co. (Subsidiary Delhi Oil Co.).—2,132 miles, proposed, Alberta, Toronto, Montreal.

Direccion General del Gas del Estado.—310 miles, 8-in., under way, Plaza Huincul to Neuquen, Argentina, to the vicinity of General Conesa, Argentina.

Northwest Natural Gas Co.—950 miles, 24-in., planned, Alberta fields to Vancouver, B. C., Seattle, Wash., and Portland, Ore.

Petroleos Mexicanos.—205 miles, 16-in., considered, Monterrey to Torreon, Mexico.

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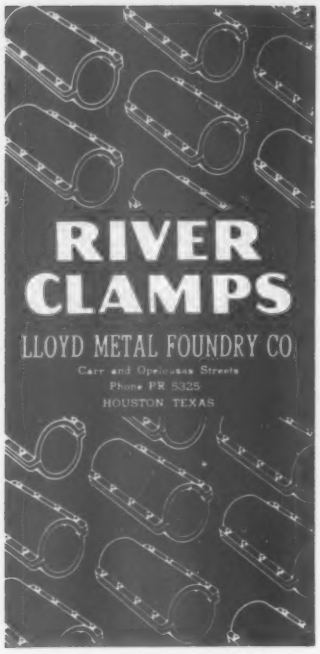

PIPE LINES

United Gas Pipe Line to Connect Ship Shoal Reserves

SHREVEPORT, La. — United Gas Pipe Line Co., of this city, is planning a new submarine line to connect gas reserves in the Ship Shoal area off the Louisiana coast with a pipe line now under construction by the company in Terrebonne Parish, Louisiana.

The company recently filed with the Federal Power Commission in Washington for permission to build the 31-mile, 20-in. line.

In the Washington testimony, United said it had signed a gas-purchase contract with Phillips Petroleum Co., Kerr-McGee Oil Industries, Inc., and Stanolind Oil & Gas Co. covering their Ship Shoal reserves. At present there is no outlet for gas produced from the blocks covered by the contract.

The new line would have a capacity of about 165,000,000 cu. ft. of gas per day and would be built at an estimated cost of $4,255,800. Its construction, United said, would augment reserves available to its enlarged system by connecting a new source which is presently estimated to contain recoverable reserves of 300 billion cubic feet.

The project would be financed by sale of securities to United's parent firm, United Gas Corp.

Cities Service Gas Gets O.K. on Kansas Expansion

WASHINGTON.—Cities Service Gas Co., Oklahoma City, has received the go-ahead from the Federal Power Commission to proceed with construction of about 21 miles of 26-in. natural-gas-transmission line in Franklin and Anderson counties, Kansas.

The company also was authorized to add a 1,000-hp. compressor unit at its Welda compressor station in Anderson County.

The new line will replace two parallel 16-in. lines. It will increase the company's capacity north of Welda by 36,000,000 cu. ft. per day and will

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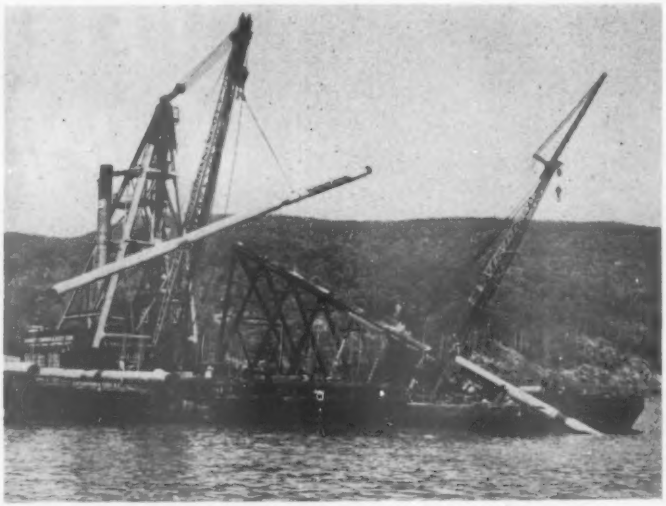

Algonquin Spans the Hudson

Floating derrick swings a 120-ft. section of concrete-coated 24-in. onto pipe skid during installation of crossing beneath the Hudson River between Tompkins Cove and Indian Park, N. Y. The crossing completed earlier this month is a part of the gas transmission line being built for Algonquin Gas Transmission Co. from Lambertsville, N. J., to Boston, with lateral lines to the southeastern part of New England. The line ties in at Lambertsville with the big-inch line operated by Texas Eastern Gas Transmission Co. The line shown being installed here is a twin to another completed in January 100 ft. north of the newer crossing. The river here is up to 50 ft. deep at mean low water, and the gas line will go 15 ft. below the river bed. Construction was by Merritt-Chapman & Scott Corp. for Ford, Bacon & Davis, Inc., engineers acting as agents for Algonquin.

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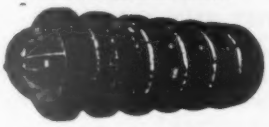

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enable it to meet increasing demands in existing markets in and around Kansas City, Kans., and Kansas City, Mo.

Total construction cost is estimated at $1,378,500, of which $1,160,000 will be for the new line and $218,500 for the new compressor unit.

Sylvania to Replace Lines, Add Compressor in New York

OIL CITY, Pa.—Sylvania Corp., of this city, has received Federal Power Commission authorization to add horsepower and replace existing lines with larger ones in Tuscarora storage field in Steuben County, New York.

The new construction, which will increase Sylvania's ability to withdraw gas from the field from the existing 15,000,000 cu. ft. daily to about 96,000,000 cu. ft. daily, will enable the company to meet increased demands for gas from its affiliate, United Natural Gas Co., also of Oil City.

Under the authorization, Sylvania will replace about 12,000 ft. of 8-in. and 6,500 ft. of 4-in. line with 12¾ and 6⅝-in. pipe and will install 400 addition horsepower at its Tuscarora compressor station.

Although capacity of the facilities will be about 96,000,000 cu. ft. daily, the rate of withdrawal is not expected to be more than 25,000,000 due to certain limitations of the facilities connecting the storage field to United's system.

United Fuel Gas Planning Storage-Facilities Expansion

WASHINGTON.—United Fuel Gas Co., Charleston, W. Va., has filed an application here with the Federal Power Commission proposing construction of pipe-line facilities in West Virginia to expand its underground-gas-storage operations and to protect and replace existing transmission facilities.

United said it planned to lay about 22 miles of lines and add about 4,840 hp. in compressor units. Total cost of the project is $3,582,640, including $1,171,040 for acquiring and activating the storage fields.

The construction would add two storage pools in Wood and Upshur counties, West Virginia, to the 13 it already operates in depleted gas fields near its transmission system.

The horsepower additions would go into a new 880-hp. station and an expansion (by 3,960 hp.) of an existing station, both in the general area of Charleston.

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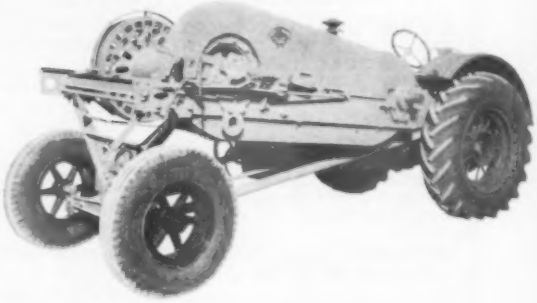

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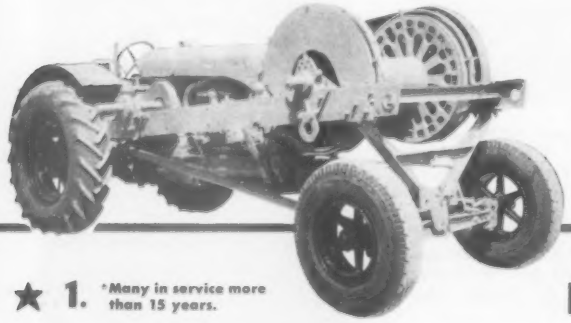

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NATURAL GAS

Operating Revenues of 87 Gas Firms Up 12½ Per Cent

WASHINGTON. — Operating revenues of natural-gas companies reporting to the Federal Power Commission increased more than 12½ per cent in February over revenues in the same month a year earlier to reach $181,324,641.

For the 12-month period ended February 29, revenues totaled about $1,663,000,000 or about 19½ per cent higher than the same period a year earlier.

The month reports filed by 87 natural-gas companies showed that net income for February was $26,536,246, 7 per cent lower than the net in February 1951. For the entire year, however, net income increased 3.8 per cent to $198,046,628.

Gas utility operating income for the month amounted to $32,119,381, down 5.7 per cent, and for the year came to $255,581,128, up 10.7 per cent over the same period a year earlier.

Net gas utility plant reached $4,271,241,746 at the end of February, a gain of 21 per cent.

Operating revenue deductions increased 17½ per cent to reach $149,364,880. Of the total, operating expenses accounted for $108,335,748, depreciation for $13,197,925, and taxes for $27,831,207.

Sales to residential and commercial consumer decreased 2½ per cent and 1.3 per cent, respectively, while those to industrial consumers gained 16.6 per cent.

Revenues from sales to ultimate consumers increased 5.8 per cent to $89,970,999. Revenues from residential consumers decreased .6 per cent while those from commercial and industrial consumers showed increases of 1.1 and 25.3 per cent, respectively.

Shell Chemical Starts New Ammonia Plant at Ventura

VENTURA, Calif.—Shell Chemical Corp. has started construction of a large ammonia plant here. The multimillion-dollar project will be capable of producing 150 tons of anhydrous ammonia daily and is scheduled for completion about a year from now.

An important feature of this plant will be the construction of a water-reclamation unit which will result in the recovery of about 1,000,000 gal. of sewer-plant effluent. The reclaimed water will be used in the ammonia plant and for drilling operations in nearby Ventura Avenue field.

To provide adequate gas to the new ammonia plant, Shell Oil Co. is doubling the capacity of its Ventura Avenue natural-gasoline plant. When the job is completed the plant will be capable of handling 150,000 M.c.f. daily.

Although not a part of this project, Shell Oil also has announced it is increasing the production of its plant in the Brea field near Los Angeles. Present producing capacity of this plant is about 26,000 gal. of natural gasoline daily.

Texas Produces 350,000 M.M.c.f. During February

AUSTIN. — Texas producers marketed a big 20.58 per cent more gas in February than in the same month in 1951, with a total of more than 350 billion cubic feet.

According to the Texas Railroad Commission's monthly report, gas produced in the state for all purposes totaled almost 413 billion cubic feet, approximately 16 per cent more than in February 1951.

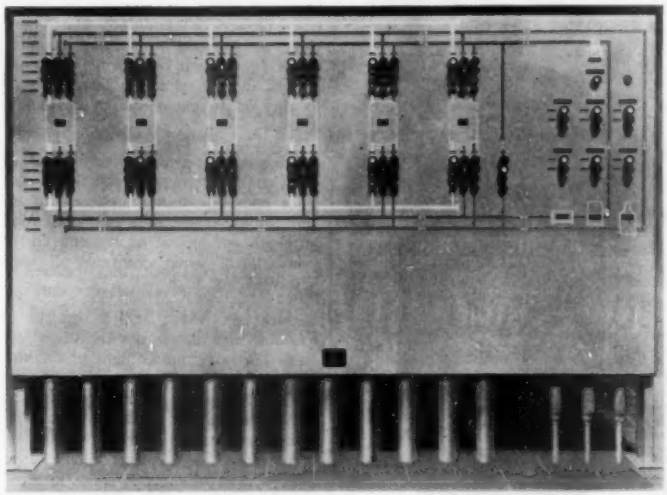
Transmission lines handled about 267 billion cubic feet of the total, or about 65 per cent. Of this, about 165 billion cubic feet was shipped out of state. Transmission companies during the month were taking more than a fourth again as much gas as in February 1951.

Disposition of gas increased in all categories except that used in cycling operations and for carbon-black manufacture, which decreased about 12 and 14½ per cent, respectively, to approximately 39.5 and 23.5 billion cubic feet.

Gas vented increased about 32 per cent during the year to reach 3.4 billion cubic feet, about .8 per cent of total production. That used for pressure-maintenance and repressuring operations totaled 21.7 billion cubic feet, up about 8 per cent.

Gas lost during extraction at plants reached 14 billion, a 23 per cent jump; while plant-fuel and lease-use consumption stood at 28 billion, up about 4 per cent.

The 16 billion cubic feet used in gas-lift operations scored the biggest gain, a resounding 36½ per cent more than was used in February 1951.



New Dehydration Controls at Oakford

One of the features of the dehydration facilities at the new Oakford natural-gas storage project near Delmont, Pa., is the automatic electrical control panel shown above in front view. The panel, built by Russell & Stoll Co., Inc., New York, uses explosionproof enclosures and components. The dehydration cycle is controlled through the actuation of 37 reversing starters mounted on six panels which are located at the pipe-line catwalks near the towers. Colored flow lines, a graphic outline of the compressor equipment, and illuminated pilot lights show the opening and closing sequence of the motor valves and the flow changes of the gases through the towers. The Oakford operation is owned jointly by New York State Natural Gas Corp. and Texas Eastern Transmission Corp. The 30,000-hp. compressor station, of which the dehydration equipment is a part, ranks as one of the world's largest.

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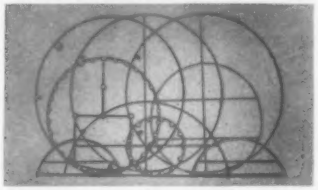

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REFINING

Lubes Reclassified

A.P.I. committee unveils new designation system

NEW YORK.—The new system of service classifications and designations for automotive lubricating oils has been revealed by the lubrication committee of the American Petroleum Institute.

The system was approved by the board of directors of the A.P.I. at a meeting in Tulsa recently (*The Oil and Gas Journal, May 12, page 206*) and had been approved beforehand by the A.P.I.'s marketing division, the American Society for Testing Materials, and the automotive industry.

It was planned by the lubrication committee to withhold details of the new classifications until it had time to prepare some educational material, but the committee changed its decision in favor of immediate announcement due to numerous requests from oil and automotive industries.

Service MS . . . Service typical of gasoline or other spark-ignition engines operating under unfavorable or severe types of service conditions and where there are special lubrication requirements for deposit or bearing corrosion control due to operating conditions or to fuel or to engine-design characteristics.

Service MM . . . Service typical of gasoline and other spark-ignition engines operating under moderate to severe service conditions but presenting problems of deposit or bearing corrosion control when crankcase-oil temperatures are high.

Service ML . . . Service typical of gasoline and other spark-ignition engines operating under light and favorable service conditions, the engines having no special lubrication requirements and having no design characteristics sensitive to deposit formation.

Service DG . . . Service typical of diesel engines in any operation where there are no exceptionally severe requirements for wear or deposit control due to fuel or to engine-design characteristics.

Service DS . . . Service typical of diesel engines operating under extremely severe conditions or having design characteristics or using fuel tending to produce abnormal wear or deposits.

Groundwork for the new classifications was laid by a special panel of the committee headed by George Round, Socony-Vacuum Oil Co., New York. The nomenclature now makes it possible for consumers to choose crankcase oils with a common denominator of engine design and application.

Further consideration will be given by the lube committee to the new classifications at its meeting in Tulsa May 27-28. Preparation of educational and informational material also will begin then, according to the A.P.I.'s information department.

Back on Stream

Explosion damage repaired at Ben Franklin refinery

ARDMORE, Okla. — Ben Franklin Refining Co.'s plant here, damaged an estimated $100,000 to $200,000 by an explosion and subsequent fire February 21, went back on stream last week.

Dr. I. A. Anson, company president, said the refinery began operating May 13 after pressure testing of vessels and other facilities for several days.

Principal damage was to the refinery's instrument system (destroyed), cooling coils (70 per cent knocked out), and fractioning towers (two of which were replaced).

Anson said the company took advantage of the down time to make long-planned changes in facilities which, together with more minor changes yet to be effected, will boost crude-processing capacity of the former 7,500-bbl. plant to 10,000 bbl. per day.

Expansion slowed . . . Ben Franklin's expansion program, under way at the refinery at the time of the explosion, was interrupted to some extent by having to divert workers from erecting new facilities to repairing damage, Anson said.

Bulldozers now are back at work leveling ground for the new units, and some of the foundations already have been completed.

The program involves installation of a new 6,500-bbl. catalytic cracking unit, a 3,00-bbl. polymerization plant, and a gas-concentration unit with a processing capacity of 7,000,000 cu. ft. per day. Completion is tentatively scheduled for about the first of February next year.

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all of the expansion work except for installation of the reactor-regenerator section of the cracker, which is under contract to Chicago Bridge & Iron Co. Little materials trouble has been encountered so far with the exception of delayed delivery of some finished equipment.

W.P.R.A.'s Wichita Program Being Put Together Rapidly

WICHITA. — The program for the second 1952 regional technical-industrial relations meeting of the Western Petroleum Refiners Association to be held here June 12-13 is beginning to take shape rapidly.

J. C. Day, managing secretary of the association, said last week that one feature of the meeting already scheduled will be a tour of Derby Oil Co.'s modernized refinery here.

The company recently announced that new units involved in its expansion program, which would raise capacity from 10,000 bbl. to a new total of 15,000 bbl. per day, were being brought on stream (*The Oil and Gas Journal, April 21, page 196*). New facilities included a catalytic cracker, a crude unit, and additional storage.

In order to pave the way for the tour, Day said, the technical sessions will be designed toward presenting papers which will deal with technical and economic aspects of catalytic operations.

In the industrial-relations program, D. R. Blazier, assistant personnel director of Mid-Continent Petroleum Corp. at Tulsa, will discuss the refinery employe-suggestion program.

Higher Gasoline Tax, New Diesel Levy Raise Revenues

WASHINGTON. — First - quarter revenues from the four federal petroleum taxes amounted to $227,722,615, an increase of $69,000,000 over the corresponding period last year.

This was credited almost entirely to the increased rate on gasoline and the new levy on diesel fuel, according to the monthly report of the Internal Revenue Bureau.

During the first 3 months of the year, the bureau announced, collections from gasoline totaled $195,206,027, against $129,119,779 in the corresponding 1951 period; lubricating oils returned $21,907,687, against $21,892,407; pipe-line transportation $7,104,846, against $7,426,361; and the new diesel-oil tax returned $3,504,055.

For the first 9 months of the Government's fiscal year, these revenues were close to $100,000,000 above the same period a year ago.

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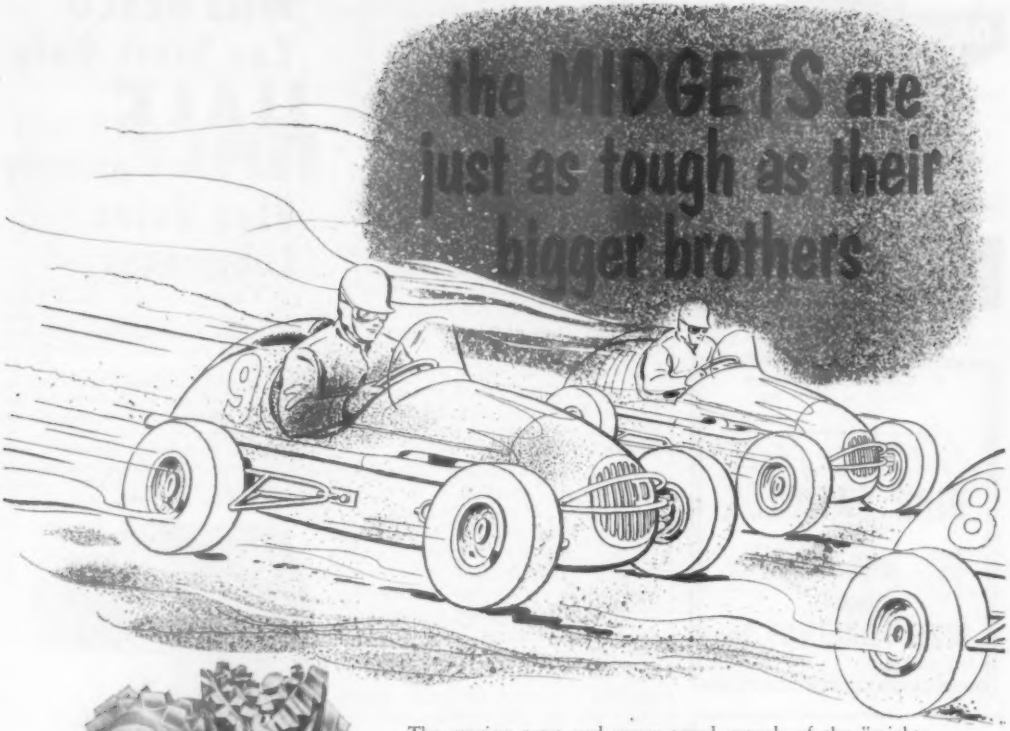

The roaring races and many speed records of the "mighty midgets" are proof enough that small size and ruggedness can go hand-in-hand. These pint-size speedsters have been clocked at better than 135 m.p.h., and it takes as much engineering and as fine materials to make one as it does to build an Indianapolis race car.

In just the same way, the smaller sizes of H. C. Smith Rock Bits are just as carefully engineered, just as ruggedly built, as the larger bits. Even the smallest H. C. Smith 4-Cutter Rock Bit features the solid pin and solid cutter brace, tying all four legs together in the *strongest rock-bit construction known.*

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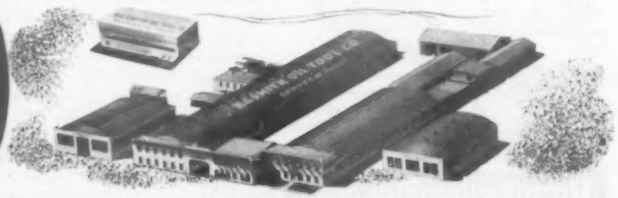

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Tulsa Drilling Company Expands Oil Operations

With plans for expanding both its drilling and exploration operations, Warren & Bradshaw Drilling Co. of Tulsa has changed its corporate name to Warren-Bradshaw Exploration Co., effective May 15, R. B. Warren, Jr., president, announces.

In its expansion program, the company has established separate drilling, production and exploration departments. Oadus White, formerly division drilling superintendent with headquarters at Oklahoma City, has been made drilling superintendent with offices at Tulsa. King H. Reed, formerly production foreman of the West Texas-New Mexico district with headquarters at Odessa, has been made production superintendent at Tulsa.

LeRoy F. Stewart, who recently joined the company as geologist, will head the newly formed exploration department.

The company, incorporated in 1936, has grown to be one of the larger drilling organizations in the industry, and now operates in all states of the Mid-Continent area. It entered the producing branch of the business in 1942 when it acquired important oil properties in Oklahoma and Texas.

Camay Becomes Division Of Parent Organization

Camay Drilling Co., Compton, Calif., wholly-owned subsidiary of Southern California Petroleum Corp., Los Angeles, has been dissolved as a corporation but will operate as a division of the parent company. It has six rotary rigs, all working in California fields.

As a result of the consolidation, R. O. Turner, formerly vice president of the drilling company, was elected vice president of Southern California and will serve as manager of Camay. W. H. Mannon, formerly drilling engineer for Camay, also was elected vice president of the parent company and will manage its engineering and geology departments.

New Illinois Contractors

Francis L. Beard and Roy Jobe, independent operators at Mount Carmel, Ill., have organized the B. & J. Drilling Co. They are starting with a string of cable tools, with which they will contract not only clean-out work but also well drilling.

3,000 Mark Passed in Number of Active Rigs

Rotary rigs operating in the United States and western Canada passed the 3,000 mark during the week ended May 12, setting a new "high" in drilling activity for this year. Last year, it was not until October that the number reached that level. Then, it was the first time that number ever had been reported.

The 3,028 rigs reported running during the above week represented an increase of 52 over the total the previous week, and 481 over the number active during the corresponding week the preceding year. The United States accounted for an increase of 32 rigs during the week. Twenty additional rigs were running in western Canada.

ACTIVE ROTARY RIGS*

(United States and Western Canada)

Area—	Week ended 5-12-52	Change week ended 5-5-52	Change week ended 5-14-51
Gulf Coast	616	+ 6	+ 62
N. & W. Tex.-N. M.	1,052	− 5	+179
Ark.-N. La.-E. Tex.	142	− 1	− 4
Oklahoma	346	0	+ 55
Kansas-Nebraska	184	+ 7	+ 27
Illinois-Eastern	144	+19	− 4
Rocky Mountains	204	+ 6	+ 79
Pacific Coast	159	0	+ 14
Total U. S.	2,847	+32	+408
Western Canada	181	+20	+ 73
Total	3,028	+52	+481

*Courtesy Hughes Tool Co. Trends in drilling activity in the United States and the Rocky Mountains and Western Canada areas are shown on pages 208 and 209.

Neal Drilling Co., Refugio, Tex., is drilling for Southern Minerals Corp., Corpus Christi, at a wildcat location 2½ miles southwest of Tivoli, in Refugio County. Contract is for 5,350 ft.

Hawke Drilling Co., Calgary, is drilling for Socony-Vacuum Exploration Co. and Western Prairie at 2-16B Fosterton, in LSD 16, 2-17-18w3, southeast extension test in the Fosterton area of southwestern Saskatchewan Province, Canada, where medium gravity crude oil was discovered earlier this year. **Paul Guthrie Drilling Co.,**

The man on the rig knows that for a tight seal and easy separation of parts you can't beat 'Bestolife Lead Seal Tool Joint and Casing Compound. Standard of the oil industry for 20 years. Unconditionally guaranteed. Sold and exported by supply houses throughout the world.

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Edmonton, has spudded Socony-Vacuum Exploration Co. and Western Prairie 23-12B Fosterton, in LSD 12, 23-17-18w3, a new extension test in the northern sector of the Fosterton area.

Harry J. Schafer, Oklahoma City, is moving in a heavy rig to a wildcat location nearly 2 miles east of the south end of the Oklahoma City fields, in Oklahoma County, where he will drill a deep test for R. W. Hibbert, Houston operator. Location is for 1 Ora Rice, in the NW NW SW 34-11n-2w. Hole is projected to at least 8,000 ft.

McCullough Drilling Co., Tulsa, is starting a projected 2,500-ft. test for Robert L. Owen of Oklahoma City at a location, 1 Widener, in the NE NE NW 27-21n-8e, 4 miles southeast of Cleveland, Pawnee County, Oklahoma. Location is north of the Lauderdale pool. Cable tools are being used.

Rhodes Drilling Co., Alice, Tex., has been given the contract for a 5,200-ft. test which Pratt-Hewit Oil Corp. of Corpus Christi is undertaking at a wildcat location 12 miles northeast of Skidmore, in Bee County, southwestern Texas.

Buzzini Brothers Drilling Co., San Antonio, is the contractor on a projected 9,500-ft. well which will be drilled directionally under the city of McAllen, in Hidalgo County, on the Mexico border. The well will be put down for Ralph E. Fair of San Antonio and is designated as 1 Horace Etchison trust.

W. C. Curry Drilling Co., Longview, Tex., has contracted with Britton, Phillips & Heartwell, Fort Worth operators, for a 5,100-ft. Pettit test to be drilled in the new Rockpoint area of Caddo Parish, northwestern Louisiana. Location is for 1 Glassell, in the SW NE NE 23-20n-15w.

Herndon Drilling Co., Tulsa, is drilling for British American Oil Producing Co. 1 Jacobson, a wildcat northeast of Sidney, Cheyenne County, Nebraska. Location is in the SW SE NW 27-14n-49w.

Thompson & Lee, Wichita Falls, Tex., are drilling on a contract with Van Grisso Oil Co. and **Sojourner Drilling Co.** of Oklahoma City at an outpost location in Okfuskee County, Oklahoma. Location is about ¾ mile from the one-well Rosenwald field, and is designated as 1 Aldridge. Immediate objective is the Union Valley-Cromwell pay, producing in the Rosenwald well, and expected at about 3,500 ft.

Cape Drilling Co. is the contractor on a rank wildcat test being started by Thomas C. Knight Oil & Gas Co. of Malden, Mo., in northern Clay County, northeastern Arkansas. Location, designated as 1 Asher, in the NW NW NW 14-21n-4e, is 3½ miles northwest of Corning.

Burnett Drilling & Production Co., Magnolia, Ark., will drill a 4,000-ft. test for M. E. Davis of San Antonio at a wildcat location 6 miles southwest of Clarksdale, in Crittenden County, Arkansas. Hole will be drilled as 1 De Mange. Location is in the SW SW NE 22-8n-7e. Rig is being moved in.

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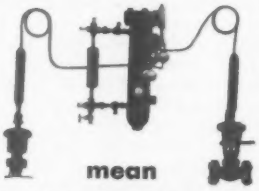

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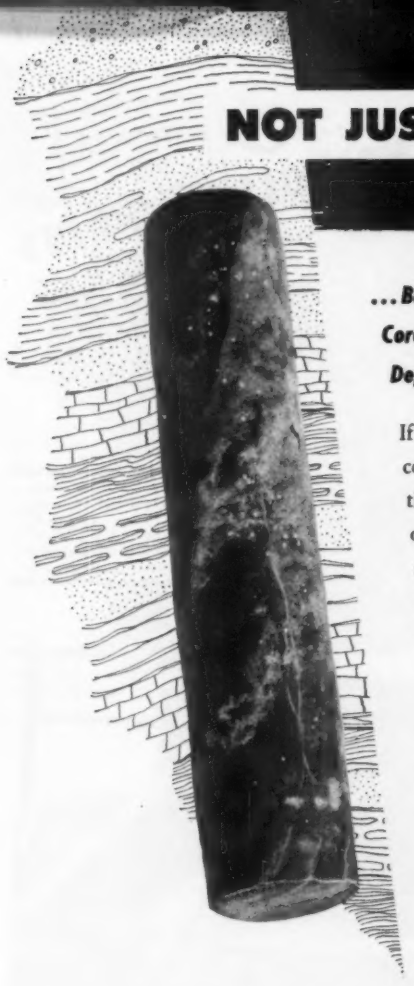

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Exploration and Drilling

Oil Finders Needed

IN the face of plans for the greatest drilling program ever attempted in the United States there is a decline in the number of geologically trained technicians moving into the oil industry—a decline in the number of men trained to make a drilling program pay off.

The Petroleum Administration for Defense has proposed a program to drill 80,000 wells during the 18-month period beginning July 1, 1952—that's about 12,500 more wells than have been dug in any previous consecutive 18-month period. Out of that 80,000 wells, possibly 10,000-12,000 would be classified as exploratory wells of one kind or another.

If these exploratory wells were drilled without the benefit of detailed technical advice they would be unlikely to find more than 1.75 billion barrels of new oil; yet if the same number were drilled with the best possible technical advice, in excess of 5.5 billion barrels of new oil could be expected.* Thus, scientific guidance is indispensable to any exploratory drilling program. In addition, pool wells need technical advice if the maximum amount of oil is to be developed with the minimum number of holes.

To get adequate technical advice for an ever-increasing number of wells means that many more technicians than are now available are needed. The demand for oil finders (geologists, geophysicists, and petroleum engineers) exceeds the supply, yet the sources of that supply are yielding fewer rather than more—there were 20 per cent fewer students majoring in geology in our colleges in 1951 than in 1950 and 20 per cent fewer in 1952 than in 1951.

The oil business starts with exploration. Without exploration there could be no oil industry. To make an exploratory effort successful, technically trained men are needed. To get these men means that the public must be informed of what the business of oil exploration has to offer those who join it.

A positive step in the direction of advising the public of just what oil exploration is and what the field offers to students was a panel discussion held in Tulsa last week as part of the regional meeting of the American Association of Petroleum Geologists. This panel was arranged and conducted by A. I. Levorsen, who opened the discussion with a picture of the general relationship of exploration to the oil industry as a whole. The introductory remarks were followed by discussions of the four specialized phases of petroleum exploration: geology by Myron C. Kiess, Mid-Continent Petroleum Corp.; geophysics by Hugh M. Thralls, Seismograph Service Corp.; land, leasing, and scouting by Condon MacKay, Carter Oil Co.; and petroleum engineering by Lloyd Elkins, Stanolind Oil & Gas Co. (See photograph in news section.)

In these prepared discussions and the question period which followed, students and parents in attendance were told of the kind of education and curricula best fitted to prepare for work in each of these fields, the type of work that could be expected, and the probabilities for employment and advancement.

The interest expressed in this panel by both students and parents indicated the value of such discussions as an aid for attracting desirable men and women into the profession of oil exploration in sufficient numbers to meet the demand for oil in war or peace. It appears that those men planning programs for the A.A.P.G., the Society of Exploration Geophysicists, and the petroleum divisions of engineering groups should seriously consider having similar discussions in conjunction with their meetings (local, regional, or national) as they are held here and there throughout the country. This would be one way to do the public relations job that Max Ball has pointed out is so badly needed.

Philip C. Ingalls

*Increase in reserve estimates are made up of revisions in recovery per acre from proven fields based on performance plus "new oil," which comes from new field discoveries and the opening of new reservoirs or extending known reservoirs in established fields. The discovery figures given are based on averages of reserve and exploratory drilling figures for the last 5 years and are only intended to illustrate difference in magnitude.

HIGHLIGHTS OF WEEK'S DEVELOPMENTS

WEST TEXAS . . . New locations around Phillips Petroleum Co. 1 Glenna in Pecos County had increased to 7 this week. Phillips announced 4 new drill sites last week and had applied for permits on 3 additional. The 1 Glenna is a rumored gas or gas-distillate Ellenburger discovery. Permits have been to 15,000 ft.

WYOMING . . . Gulf Oil Corp. recovered 4,760 M.c.f. of gas and 384 bbl. of distillate on 24-hour production test from the Phosphoria at 1 Stockham Federal, wildcat in the Southwest Worland area, Washakie County.

MONTANA . . . Shell Oil Co. has announced an aggregate estimated rated production of 6,700 bbl. of oil daily from a possible five pay zones in the Devonian-Ordovician at the Cedar Creek extension test.

OKLAHOMA . . . Carter Oil Co. 1 Keith C. Rosendale flowed 25 bbl. of distillate and 2,170 M.c.f. of gas in 15 hours through ¾-in. choke from Morrow sand. The important Ellis County wildcat is located in the northwestern Oklahoma portion of the Anadarko basin, 18 miles southeast of the recent Morrow gas-distillate discovery in Harper County.

California

Search For Deep Production Continues At Signal Hill

LOS ANGELES.—In the Signal Hill area of Long Beach field, efforts were being continued to find deep production such as was done at Wardlow pool about a year ago. Richfield Oil Corp. was getting under way with 1 Hodges Community which will be slanted from a surface location near 37th Place and Long Beach Blvd. Hancock Oil Co. also shortly is expected to get under way with 51 Signal, which will be started from the location where several Wardlow pool wells were drilled.

Hancock, joined by Union Oil Co. and General Petroleum Corp., has abandoned 50 Signal after drilling to 8,348 ft. and then redrilling from 1,660 to 8,032. When the first hole missed the fault block pool the new hole was slanted about 2,000 ft. to the north in an effort to establish production in the California Heights area. The triad has formed a community lease comprised of approximately 2,000 town-lots there and this was the first test of the block.

The City of Long Beach is making plans for leasing 1,027 acres of airport land immediately to the north and east of this activity. In 1947 a De Soto sand play, and subsequent activity, focused attention on the possibilities of similar deep production underlying the airport. Air Force leases which have prevented exploration thus far now have lapsed.

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If the city proceeds with its plans it is anticipated there will be a spirited bidding for exploratory rights. It is proposed that drilling largely would be slant-hole from drill sites adjacent to the airport lands.

Within the next few days success or failure may be written at two extension tests and a wildcat in the Castaic Junction area of upper Santa Clara Valley. At its 85-1 Golden in NE SE 35-3n-17w, a two-location south stepout to the northwest portion of Castaic Hills, Standard of California was drilling below 6,100 ft. Because of its importance in determining the field's width in this area, the extension test was being closely watched.

About ½ mile east of Castaic Junction field, in NW NE 19-4n-16w, Standard 52-19 Newhall Land-6 was coring ahead at 13,184 ft. At shallower depths the wildcat picked up the three reservoirs which Humble Oil & Refining Co. is developing in the field, and though the sands were oil stained they were wet.

Further south of this activity in Sec. 33, Humble 1-E Newhall land was coring in sands which showed indications of being high-pressure, low-volume producers. At last reports a core had been pulled from 10,073-84 ft. Formation tests made in the interval between 10,049-73 ft. resulted in the recovery of the water cushion and several hundred feet of gas-cut mud.

CALIFORNIA SUCCESSFUL WILDCATS

Kern County, new field discovery 2 miles southeast of Devils Den field: Yellowstone Oil Co. 12-1 Still-Mabury, NE SE 1-26s-18e, pumped 12 bbl. oil and 30 bbl. water, per day, 13.5 gr. crude, Oceanic 415 ft. TD 457 ft., plugged back to 225 ft.

Ventura County, deep Sespe zone discovery in Torrey Canyon field: Union Oil Co. 83 Torrey, SW NE 5-3n-18w, pumped 600 bbl. per day through perforations at 7,725-9,326 ft., 18:5 gr. crude, 5.2 per cent cut. TD 9,327 ft., elev. 2,005 ft.

CALIFORNIA WILDCAT FAILURES

Fresno County, Camden area: Monterey Oil Co. 1 Marley, 36-16s-19e, dry, TD 6,088 ft., elev. 345 ft.

Huron area: General Pet. Corp. 44-14 B.L.C., 14-20s-18e, dry, O.W.R.D. old TD 14,724 ft., redrilled from 12,485 ft. to 13,193 ft., elev. 279 ft.

Raisin City area: R. Giffen 1 Harris Farms, Inc.-Giffen, 21-14s-16e, dry, TD 6,202 ft., elev. 177 ft.

Kern County, Edison Groves area: Jocar Oil Co. 1 Buck, 28-29s-29e, dry, TD 5,006 ft., elev. 611 ft.

Kern River area: Seaboard Oil Co. 35A-22 Seaboard, 22-28s-28e, dry, Vedder 3,204 ft., TD 3,270 ft., elev. 940 ft.

McVan area: J. Yateman 1 Fitzhugh-USL, 14-27s-27e, dry, TD 3,324 ft., elev. 893 ft.

Sharktooth area: Wood-Callahan Oil Co., Ltd., Opr. 14-1 "Well," 14-28s-28e, dry, TD 2,500 ft., elev. 1,182 ft.

Tejon Hills area: Simian Oil Co. 1 Grober, 12-11n-18w, day, bottomed in basement, TD 652 ft.

Tejon Ranch area: E. B. Hall & Co., 2-11 Hall, 11-10n-19w, dry, TD 465 ft., elev. 1,045 ft.

Los Angeles County, Long Beach area: Hancock Oil Co. 50 Signal, 18-4s-12w, dry, TD 8,348 ft., elev. 98 ft.

Monterey County, Moss Landing area: Precision Drilling Co. 1 Capurre, 6-13s-2e, dry, TD 1,561 ft., elev. 80 ft.

Peachtree Valley area: Union Oil Co. 3 Mee, 33-19s-10e, dry, TD 5,360 ft.

Powell Canyon area: The Texas Co. 1

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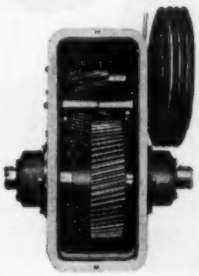

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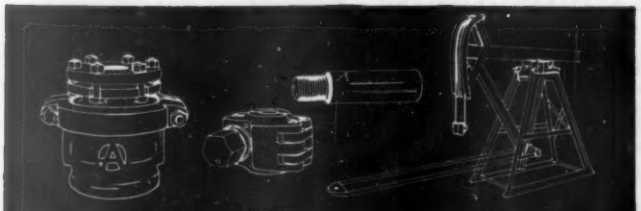

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Nichols, 13-23s-11e, dry, TD 3,404 ft., elev. 1,350 ft.

San Ardo area: The Texas Co. 95 Rosenberg, 34-22s-10e, dry, TD 2,596 ft., elev. 448 ft.

Santa Barbara County, Harris area: Union Oil Co. A-2 Harris, 12-8n-34w, dry, TD 9,515 ft., elev. 475 ft.

Sutter County, Marysville Buttes area: Richfield Oil Corp. 2 Butte Comm. A, 9-16n-2e, dry, TD 4,854 ft., elev. 85 ft.

Tulare County, Richgrove area: Continental Oil Co. 1 Konda, 26-24s-27e, dry, bottomed in basement, TD 2,014 ft., elev. 625 ft.

ARIZONA WILDCAT FAILURE

Coconimo County: Sinclair O & G Co. 1 Santa Fe, 35-28n-1w, dry, Pennsylvania 1,858 ft., Devonion 2,912 ft., Cambrian 3,010 ft., TD 3,544 ft., elev. 6,005 ft.

Canadian Fields

Saskatchewan Reports Heavy Crude Strike

CALGARY.—Another heavy crude oil discovery has been made in Saskatchewan, at a wildcat being drilled by the team of Husky Oil & Refining Co. and Phillips Petroleum Co. of Oklahoma. The strike was made in the Hoosier area, about 33 miles northwest of Kindersley, 20 miles west-southwest of the Driver area Viking sand light oil discovery and 6 miles east of the Alberta border.

The Husky-Phillips team's new discovery was made in the Detrital zone of the Lower Crecaceous, but the well also gave up moderate flows of gas from the Viking, and gave some slight showings of oil in that formation. Phillips-Husky 1 Hoosier, on LSD 13, 11-31-28w3, contacted the Viking at 2,473 ft., and tests in that horizon down to 2,510 ft. gave up gas flows ranging to an estimated 200,000 cu. ft. daily plus gas-cut mud with slight oil showings.

The Cretaceous was contacted at 2,690 ft., and the Detrital zone was encountered at 2,780 ft. One-hour test from 2,815-40 ft. gave a strong steady blow and recovery of 145 ft. of heavily oil and gas-cut mud. Ninety-minute drill-stem test from 2,813-50 ft. gave a flow of natural gas to the surface in 16 minutes, was unmeasured, but burned in a 2-ft. flare. Fluid recovery consisted of 1,146 ft. of heavily gas-cut oil, with gravity about 15°-16°, and 30 ft. of heavily oil-cut mud. Coring and testing is being continued.

CANADIAN WILDCAT FAILURES

Hudson's Bay—Union Royalite 1 Chinook, LSD 16, 24-85-24w5, TD 6,953 ft.

Canada Southern—Brown 2 Tellington, LSD 13, 17-52-5w4, TD 2,021 ft.

Northern Development Amalta 1 Concord LSD, 8, 17-50-27w4, TD 7,005 ft.

Cal-Standard 1 Narrow Lake LSD 5, 19-65-24w4, TD, 4,865 ft.

EASTERN CANADA

In Aldborough township, Elgin County, Western Ashley 1 Tom Morrison farm, finished at 1,489 ft. has a measured gas production of 500,000 cu. ft. Western Ashley has moved equipment to the Fulton farm, Lot 13, Concession 1 Aldborough for No. 2.

In Essex County, Western Ashley and Anchor Petroleums have moved a rig to the Crozier farm, on the Comber Side Road north of Staples, and will drill to 1,200 ft.

1. Cementrol is hydraulically actuated by the mud pumps. Shown above in "set" position.

2. Flapper-Type Float Collar allows passage of actuating bridging ball and provides positive seal against return flow of cement.

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Hoot Mon! H'a' Ya Met R. Elmo Thompson?

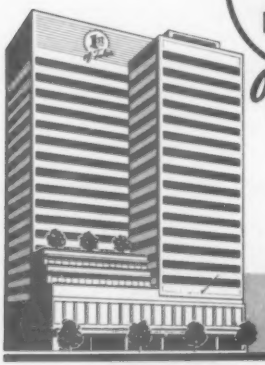
The reformed Scotch lawyer on the left is a transplanted Tennessian. A graduate of Vanderbilt, he came to Tulsa with a Southern drawl (which he still has) and a lot of ambition (which he has attained).

Starting in the Legal Department of a Tulsa bank, he became a director and VP of THE FIRST in 1935. Except for a stint as VP of Sunray Oil he has been with us ever since: in charge of Correspondent Bank activities, Member of the Board, Senior VP and on the Trust Committee.

Elmo is active in national ABA activities, chairman of the Executive Council of OBA, and has a list of civic honors much too long to mention.

He is a trustee of Tulsa U., but even ahead of civic work comes golf. So when you come in to meet him, please don't mention golf, or we won't be able to get any work out of him for hours.

Think 1st of Tulsa



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Production is expected at 1,165 ft. The test is higher on structure than the Imperial well at Staples which some years ago got a good initial showing, but failed to hold up.

Permian Basin

More Ellenburger Pay Found At Andrews Wildcat

MIDLAND.—Magnolia Petroleum Co. 1 University, eastern Andrews County discovery, found additional Ellenburger pay and the water table in drill-stem testing between 13,895-918 ft. According to reports, the discovery will have a net of around 75 ft. of pay section in the Ellenburger and was to be completed from that formation. The wildcat also had oil in the Devonian.

On the above interval test, oil flowed in 2 hours and 18 minutes, gaging 36.4 and 27.9 bbl. of oil the first and second hours. Recovery in the pipe included 300 ft. of sulfur water. Bottom-hole flowing pressure reached 4,895 psi., and shut-in pressure gaged 6,040 psi.

Gulf Oil Corp. and Jack Frost 1 Northrup, Reeves County wildcat, had developed additional oil after treating with acid from 9,890-9,983 ft. in a section that has been called Wolfcamp.

Previous to acid treatment, swabbing yielded 4 bbl. of oil in 7 hours, with fluid level at 9,500 ft. After treating and 7 hours of swabbing, the well kicked off and flowed 21 bbl. of oil and 1 bbl. of fluid in 3 hours.

Spraberry production was moved 2½ miles southwest of the southern portion of Pembrook field of Upton County at E. Constantin, Jr. 1 D. M. Oldham, which completed for 262 bbl. of oil a day through ½-in. choke from pay at 6,900-7,300 ft., total depth. Top of pay at 6,900 ft. was on elevation of 2,711 ft.

Two offset completions to the previously lone producer in the Block 11 field of Andrews County has assured that area further development.

Larger of the two new wells was Phillips Petroleum Co. 2-DD University, a southeast extension, which flowed 350 bbl. of oil in 8 hours through ½-in. choke, to rate a calculated daily potential of 1,050 bbl. Production was from perforations in the Devonian at 8,010-55 ft. Previous to completion, the well had flowed as high as 94 bbl. of oil in 1 hour on drill-stem test.

North of the discovery well, Phillips 1-HH University rated a daily flowing potential of 130 bbl. of oil, through 20/64-in. choke from perforations at 8,190-8,250 ft.

Phillips was moving in for a south offset to the 2-DD University, to be drilled to 8,200 ft.

The Texas Co. made location for its 1-AB State in 22-11-University Lands Survey, as a 12,600-ft. Devonian wildcat. Location is some 6½ miles north and slightly east of Magnolia's 1 University in Andrews County.

WEST TEXAS (DISTRICTS 8 AND 7-C SUCCESSFUL WILDCATS

Reagan County: Humble Oil & Refining Co. 1-H Sawyer Cattle Co., Sec. 9, Blk. A. J. F. Jackson Sur., TD 6,475 ft., elev. 2,615 ft., pay 5,495 ft., IP pumped 9 bbl. oil.

Scurry County: McAlester Fuel Co. 1-A T. P. Allen, 75-20-LaVaca Navigation Co. Sur., TD 8,410 ft., Strawn pay 7,442 ft., IP 265 bbl. 41°-gravity oil, ¼-in. choke, TP 620 psi., GOR 1,022 cu. ft.

The Texas Co. 108 Fuller, Sec. 1, Kuken-

dall Sur., TD 7,969 ft., elev. 2,300 ft., pay 7,110 ft., IP pumped 125 bbl. 33°-gravity oil.

WEST TEXAS (DISTRICTS 8 AND 7-C) WILDCAT FAILURES

Andrews County: Ada Oil Co. 1 Cleveland, 15-A41-PSL, dry, TD 8,430 ft., elev. 3,338 ft., Devonian 8,140 ft.

Borden County: Baker & Taylor Drilling Co. 1 W. D. Johnson, Jr., 41-32-T5N-T&P, dry, TD 8,470 ft., elev. 2,592 ft., Spraberry 6,120 ft., reef 8,320 ft.

Concho County: Saxon Exploration Co. 1 Jess Stephens, Sec. 1,941, A. M. Schutz Sur., dry, TD 3,003 ft., elev. 1,971 ft., Ellenburger 2,852 ft.

Gaines County: The Texas Co. 10 A. B. Wharton, Jr., 7-A21-PSL, dry, TD 6,151 ft.

Hudspeth County: J. L. Cowley 1 E. C. Mowry, 37-70-T2-T&P, dry, 3,092 ft., Glorietta 850 ft., Clear Fork 1,110 ft., Wolfcamp 1,490 ft., Pennsylvanian 1,960 ft., Mississippian 2,205 ft., elev. not reported.

Mitchell County: Union Sulphur & Oil Corp. 1 E. E. Erwin, 1-25-H&TC, dry, TD 7,584 ft., elev. 2,305 ft., reef 7,531 ft.

Pecos County: R. H. Henderson 1 Wilson, 10-112-TCRR, dry, TD 170 ft.

Runnels County: Clark & Cowden 1 J. A. Morrison, 23-515-A. Losoya Sur., dry, TD 215 ft.

Miami Operating Co. 1 Lynn Stokes, Sec. 151, RR Sur., dry, TD 4,122 ft., elev. 1,715 ft., Serratt 2,355 ft., Palo Pinto 3,254 ft., Caddo 4,054 ft.

Skiles Oil Corp. 1 A. S. Dickenson, N. Taylor Sur. 363, dry, TD 4,140 ft.

Terrell County: BTL Co. 2 Goldwire, 95-1-TCRR, dry, TD 3,038 ft.

TEXAS PANHANDLE (DISTRICT 10) SUCCESSFUL WILDCAT

Gray County: T. J. Wagner, Jr. 1-B Yoes, 4-R-BS&F, TD 2,358 ft., elev. 2,812 ft., gas pay 2,284-2,340 ft., IP 4,000,000 cu. ft. of gas, RP 423 psi.

TEXAS PANHANDLE (DISTRICT 10) WILDCAT FAILURE

Armstrong County: Hassie Hunt Trust 1 Maude Helms, 2-2-H&GN, dry, TD 6,520 ft. elev. 3,174 ft., granite wash 6,070 ft., pre-Cambrian 6,260 ft.

SOUTHEASTERN NEW MEXICO

Humble Oil & Refining Co. completed its 1 Federal-Elliott as a Pennsylvanian discovery, for a daily potential of 256 bbl. of 51°-gravity oil. The flow was through ¾-in. choke on tubing, with 400 psi. pressure on tubing and with gas-oil ratio of 17,686 cu. ft. Final perforations were from 12,880-13,175 ft.

Wilshire Oil Co. prepared to complete its 1 Townsend in 4-16s-35e, as a Pennsylvanian discovery. According to field sources, the perforating gun was blown out of the hole after shooting from 10,410-500 ft. and the well then flowed clean oil through the casing. A control head was being installed prior to running production tests.

Joseph I. O'Neill, Jr. 1-A State, wildcat in east-central Lea County, had indicated a discovery in the Abo section of the Wichita-Albany, but the oil turned to water and the operator moved in a workover rig to plug back. Perforations at 7,440-79 ft. were to be squeezed and further testing made in the Drinkard sand around 7,032-66 ft.

SOUTHEAST NEW MEXICO SUCCESSFUL WILDCATS

Lea County: L. E. Elliott 1-H Elliott-Federal, 31-24s-38e, TD 8,691 ft., elev. 3,144 ft., Silurian pay 8,580 ft., IP 490 bbl. 42°-gravity oil a day on gas lift.

Phillips Petroleum Co. 1-A Pello, 2-15s-32e, TD 10,335 ft., elev. 4,302 ft., pay 8,970 ft., IP pumped 47 bbl. 40°-gravity oil.

SOUTHEAST NEW MEXICO WILDCAT FAILURES

Eddy County: A. F. Schabel 1 Beeman 11-24s-28e, dry, TD 3,016 ft., elev. 2,969 ft., Delaware lime 2,595 ft., sand 2,630 ft.

Lea County: Joseph I. O'Neill 1 M. S. Bennett, 16-20s-38e, dry, TD 500 ft.

O'Neill et al 1 Karnegay, 21-20s-38e, dry, TD 9,506 ft., elev. 3,580 ft., Abo 7,330 ft., Woodford 9,040 ft., Devonian 9,210 ft.

The Texas Co. 1-BF State, 2-12s-32e, dry, TD 11,371 ft., elev. 4,372 ft., Abo 7,140 ft., Mississippi 10,800 ft., Devonian 11,322 ft.

Roosevelt County: Great Western 1 Billberry, 1-7s-37e, dry, TD 8,113 ft., elev. 4,026 ft., Abo 6,730 ft., Pennsylvanian 7,730 ft., granite wash 7,930 ft.

Louisiana-Ark.

Tanks Being Erected At Concordia Confirmation

SHREVEPORT.—H. L. Hunt et al are erecting tanks for completion at 1 C. F. Farrar, Section 4-6n-7e in Concordia Parish, confirmation attempt for the newly discovered Ross Bayou field.

The test is located 1,500 ft. east of the discovery well, Serio 1 Burrell. Operator recorded a flow of 140 bbl. of oil daily through ¼-in. top and ⅝-in. bottom chokes on drill-stem test between 5,608-14 ft. in the upper part of a 24-ft. sand section in Wilcox. Seven-inch casing has been set to 5,704 ft. for production.

The test found sand producing in the discovery well, shaled out, but found the second sand approximately 19 ft. higher than the discovery.

Ross Bayou field is located about 2¼ miles northwest of Lisemore landing field and about 2½ miles east of Willow Lake field, across the Black river in Catahoula Parish.

Hunt has spudded and is drilling at about 450 ft. at a second test in the same section as the other two wells, the 2 C. F. Farrar.

Monla Gas Co. and Feazel Interests have staked location for a 10,500-ft. exploration test at 1 G. P. Stubbs, 1,220 ft. from south line, 1,400 ft. from west line of Section 16-18n-5e. The test is located 2 miles southeast of Swartz 2½ miles southwest of the Monla and Feazel recent gas-condensate discovery.

The discovery well, 1 Breece Lumber Co., SW NW 3-18n-5e, is waiting on state gage before being put on production. Production is from perforations at 7,343-69 ft. in the Cotton Valley, flowing 8,000 M.c.f. of gas daily.

LOUISIANA WILDCAT FAILURE

Concordia Parish: Barnett Serio et al 1 Watson-Middleton, C SE SE 18-7n-7e, dry, 6,515 ft.

ARKANSAS WILDCAT FAILURES

Nevada County: Munoco Co. 1 O'Keefe, 660 ft. S and 255 ft. W NEc NW SW 5-14s-21w, dry, TD 4,128 ft.

Ouachita County: W. J. Budd et al 1 Daniels, 450 ft. S and 600 ft. E NWc NW SW 28-19s-17w, dry, TD 3,021 ft.

Southwest Texas

Wilson Wildcat Swabs Oil From Buda Lime

CORPUS CHRISTI.—Wise Drilling Co. and J. C. McCabe 1 E. Hayden, Wilson County wildcat in the Higgins-Borrego Creek area, is swabbing approximately 2,000 bbl. of 25.5°-gravity oil daily from perforations in the Buda lime at 5,723-90 ft. Sulfur water was tested earlier in the Edwards. This venture is located 4,700 ft. north of Martin, Shelly and Thomas and Wise 1 Higgins, Austin Chalk discovery of last year, which swabbed at the rate of 7,000 bbl. daily. This venture then flowed 328 bbl. of oil daily through 3/16-in. choke on potential test from perforations at 5,590-5,632 ft.

New pay is being opened in Tal Vez field, Webb County, at Campbell, Pearl, Calohan and Rowden A-9 Kirkpatrick. On a 25-minute drill-stem test at 1,904-10 ft., using ¼-in. chokes, recovery was 1,800 ft. of 45°-gravity oil. Another test at 1,920-30 ft. recovered 60 ft. of oil and water through ¼-in. chokes. Operators have set 5½-in. casing at total depth of 1,957 ft. to complete the venture.

First Edwards lime production in the Salt Flats area of Caldwell County, is indicated at Texola Drilling Co. B-2 Clyant Smith, which has been deepened from 2,680 ft. to 2,788 ft. From 1-shot perforation in the lower Edwards at 2,710 ft., the well made 17.5 bbl. of 38.5°-gravity oil daily and no water. Operator is now preparing to set production liner. This discovery is located in James Hindes Survey, 6 miles northwest of Luling.

H. H. McFarland has completed a dual well opening 2 new sands in Bluntzer field, Nueces County. The venture, 2 Fannie B. Nason, flowed 127 bbl. of oil daily through ⅛-in. choke from perforations at 5,904-14 ft. From perforations at 5,749-56 ft., the well flowed gas.

SOUTHWEST TEXAS (DISTRICTS 1 AND 4) SUCCESSFUL WILDCATS

Jim Hogg County: oil discovery—Armstrong & Cotton, Inc., 3 Downs Royalty Corp., El Javali Grant, Beer & Coffee Subd., Blk. 51, TD 2,333 ft., open hole 2,328¼-33 ft., IP 20 bbl. oil per day, 34.7° gravity.

Jim Wells County: oil discovery—Morris Cannan 1 K. Spoetzel, J. Poitevent Sur., A-358, TD 5,395 ft., perf. 3,420-30 ft., IP 18 bbl. oil per day, 43° gravity.

SOUTHWEST TEXAS (DISTRICTS 1 AND 4) WILDCAT FAILURES

Bastrop County: Frank S. Green 1 Lee Alexander, J. Blalock League, A-91, dry, TD 1,872 ft.

Ed. Peterson & J. A. McCarty 1 Frank Carroll, Freeman Wilkerson Sur., dry, TD 2,892 ft.

Duval County: Dunlap & Corning 3 Duwel Co., J. Poitevent Sur., A-844, Sec. 202, dry, TD 4,275 ft.

Frio County: Kirkwood & Morgan, Inc., 1 Albert Klopek, LIM&C Co., Sur. 9, dry, TD 5,415 ft.

Nueces County: P. R. Rutherford 1 Katherine L. Shaffer, 268 acre lease in Subd. of Mary Luby Petronilla Ranch Blk. 3, Lot 7, dry, TD 8,450 ft.

Starr County: Gorman & McCaleb 2 Manuel Hinojosa, Porcion 111, Jose Antonio Guajardo Sur., dry, TD 3,190 ft.

Harry L. Martin et al 1 R. C. Ross, Jr.

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et al, Porcion 93, Share 107, dry, TD 3,524 ft.

Webb County: Sid Katz et al 1 Dr. Raul de la Garza, CCSD&RGNG Sec. 48, Blk. 1, dry, TD 2,786 ft.

P. R. Rutherford et al 1 Earl W. Baker, CCSD&RGNG Sec. 55, Blk. 1, dry, TD 2,520 ft.

Zapata County: N. B. Hunt 1 Robert Hinnant, SK&K Sur. 74, dry, TD 1,855 ft.

Karl Michel 1 Lee Akin, La Perla Ranch Dolores & Corralitos S:bd. of Jose Basquez Borrego Grant, dry, TD 3,025 ft.

Panhandle Producing & Refining Co. 1 J. C. Martin, El Ranchito Subd. & Blas Urbide Subd., Blk. 5, Jose Borrego Grant, dry, TD 2,121 ft.

South Louisiana

Deep Allen Venture Plugged and Abandoned

NEW ORLEANS. — Magnolia Petroleum Co. has plugged and abandoned its deep venture, D-1 Ragley Lumber Co., 29-5s-7w, Allen Parish, at total depth of 18,660 ft. This well set a new depth record in the Gulf Coast area. It was tested extensively before being plugged and on latest test, flowed 100 per cent salt water through a 7/64-in. choke.

Potential test has been run at Pan American Production Co. 1 Archille Andrepont, 42-8s-1w, new oil discovery in Acadia Parish located 2¼ miles north of Iota. From perforations at 9,268-74 ft., the well flowed 79 bbl. of 33.2°-gravity oil daily through 8/64-in. choke. Hole is bottomed at 10,746 ft. with 5½-in. casing cemented at 10,500 ft.

Union Producing Co. and Texas Gulf Producing Co. have run potential test on C-1 LaTerre Co., 109-20s-18e, oil discovery in the Dulac area of Terrebonne Parish. Through ¼-in. choke, the well flowed 144 bbl. of 46.8°-gravity oil daily plus 5,448,000 cu. ft. of gas daily. Production is from perforations at 14,148-56 ft. and is flowing under tubing pressure of 4,432 psi. Operators set 5-in. casing at 14,164 ft.

Another oil discovery has been potentialed at Shell Oil Co. 1 J. A. Bel, 5-6s-3w, Allen Parish, 3 miles north of Elston field. Under tubing pressure of 260 psi., the well gaged 40 bbl. of 27.4°-gravity oil daily through P-26 choke. The new discovery is flowing through perforations at 5,891-93 ft. No other shows were indicated on several logs which were run prior to taking potential.

Superior Oil Co. is preparing to test its apparent discovery on the Rockefeller Wildlife Preserve and Game Refuge in Cameron Parish. Perforations have been effected at 11,134-40 ft., which are the first of 5 tests to be made. From last perforations at 9,952-58 ft., the well flowed 122 bbl. of 55.5°-gravity distillate through a 22/64-in. choke.

SOUTH LOUISIANA SUCCESSFUL WILDCAT

St. Charles Parish: gas-condensate discovery —The California Co. 1 Geo. Montgomery et al, 85-12s-19e, TD 11,700 ft., perf. 10,250-78 ft., IP 81 bbl. condensate per day, 3/16-in. choke, TP 3,550 psi., 52.8° gravity.

SOUTH LOUISIANA WILDCAT FAILURES

Beauregard Parish: Vincent & Welsh, Inc., et al 1 Lucher Moore Lumber Co., 34-5s-12w, dry, TD 8,407 ft.

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Lafourche Parish: Union Oil Co. of California 2 Bowie Lumber Co. 11-14s-17w, dry, TD 12,308 ft.

Plaquemines Parish: Gulf Refining Co. 1 Louisiana St. Le. 1913, in Blind Bay, dry, TD 10,120 ft.

St. Mary Parish: Cities Service Oil Co. 1 St. Le. 1805, 16s-8e, dry, TD 13,000 ft.

North-Central Texas

Caddo Discovery Completed In Montague County

WICHITA FALLS.—Standard Oil Co. of Texas completed its 1 L. T. Mosley, M. B. Lewis Survey, as a Caddo conglomerate discovery. The new well, 4 miles southeast of production in Bonita field of Montague County, and 3 miles west of St. Jo, is expected to encourage exploratory drilling in the area between Cunningham and Etter fields.

The 1 Mosley had top of the Caddo at 6,322 ft., pay at 6,607 ft. and total depth at 7,200 ft. Potential, on the pump, was 153.6 bbl. of oil a day.

New wildcats for Montague County included King and Heyne, Inc. 1 Wilson, a 6,800-ft. test 8 miles northeast of Ringgold on a 118-acre tract in the W. R. Gaston Survey. Joe Reznick 1 Y. H. Yarbrough, 5½ miles northwest of Stoneburg in the J. W. Massie Survey, was scheduled to 6,500 ft. Third test was Tobe Foster 1 T. Fenoglio, 6 miles southwest of Nocona in the T. J. Moss Survey, and projected to 3,100 ft.

In Jack County, Bridwell Oil Co. 1 J. E. Henderson established shallow sand production about 3 miles southwest of Bryson. On completion test it flowed 84 bbl. of 41°-gravity oil a day through 11/64-in. choke, from 8 ft. of pay starting at 2,321 ft. Location in the John Hill Survey is approximately 1 mile east of deeper production.

In Throckmorton County, Warren Oil Corp. 1 Bogan Higgs, Section 681, TE&L Survey, extended Mississippian production to the southeast in the pool 3 miles southeast of Woodson. Final gage was 296 bbl. of oil a day through 14/64-in. choke, from pay at 4,444-52 ft.

In south-central Taylor County, Kerr-McGee Oil Industries, Inc. 1 Kerby found considerable gas, plus a spray of oil, in the Gray sand. The well sprayed oil and gaged over 7,000,000 cu. ft. of gas a day on a drill-stem test at 4,527-60 ft. It was drilled to 4,559 ft., cased and perforated between 4,550-59 ft., then made 950,000 cu. ft. of gas after swabbing down. Top of the sand was 4,526 ft., on elevation of 2,072 ft.

NORTH CENTRAL TEXAS (DISTRICTS 9 AND 7-B) SUCCESSFUL WILDCATS

Coleman County: W. J. Murray 1 J. G. Wilson, T&NO Sur. 10, TD 3,452 ft., elev. 2,006 ft., pay 3,404 ft., IP 144 bbl. 42°-gravity oil, 20/64-in. choke, TP 135 psi., GOR 900 cu. ft.

Haskell County: Mid-Continent Petroleum Corp. 1 J. J. Thomas, 29-1-H&TC, TD 5,385 ft., perforated 5,292-5,300 ft., IP 208 bbl. 40°-gravity oil, 20/64-in. choke, TP 375 psi., GOR 595 cu. ft.

Youngblood & Foree 1 Kleiner Est., R. Langham Sur., A-307, TD 3,347 ft., limestone pay 3,340 ft., IP pumped 107.5 bbl. 39°-gravity oil.

Jones County: Robinson-Puckett, Inc. 1 F. C. Keen, Sec. 49, D&DAL Sur., TD 3,644

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ft. elev. 1,617 ft., pay 2,185 ft., IP pumped 233 bbl. 39°-gravity oil.

Montague County: Tom B. Medders 1 Ernest Eggenbacher, Sec. 90, Hill CSL, TD 6,856 ft., pay 5,225 ft., IP pumped 131 bbl. 43°-gravity oil.

Stephens County: Connally Jackson 1 Nettie Ledbetter, T&NO Sur., A-220, TD 1,933 ft., elev. 1,477 ft., pay 1,922 ft., IP 24 bbl. 37°-gravity oil, ½-in. choke, TP 130 psi., GOR 1,800 cu. ft.

Connally Jackson 1 Sikes heirs, Sec. 3, BAL Sur., TD 2,270 ft., pay 2,230 ft., IP 18 bbl. 38°-gravity oil, ½-in. choke, TP 110 psi., GOR 870 cu. ft.

Delta Drilling Co. 1 B. McCrea, W. Edmondson Sur., TD 4,209 ft., Ellenburger pay 4,177 ft., IP 350 bbl. 47°-gravity oil, 5/16-in. choke, TP 150 psi., GOR 402 cu. ft.

Wichita County: Tobe Foster 1 Lochridge, L. Netherly Sur., TD 4,332 ft., pay 3,992 ft., IP 180 bbl. 42°-gravity oil, 14/64-in. choke, TP 190 psi.

NORTH CENTRAL TEXAS (DISTRICTS 9 AND 7-B) WILDCAT FAILURES

Archer County: Reno Oil Co. 1 Petrex, Lot 998, Blk. 84, ATNCL, dry, TD 3,796 ft., Gunsite 1,574 ft.

Texoma Drilling Co. 1 L. Kinder, Blk. 51, Clark & Plumb, dry, TD 1,277 ft.

Callahan County: The Federal Co. 1-A Kenard, Sec. 9, ETRR, dry, TD 1,902 ft.

Coleman County: J. H. Gilliam 1 J. H. Brown, Sec. 10, HT&B, dry, TD 3,585 ft.

Ranger Oil Co. 1-A Laughlin, Stewart Perry Sur. 194, dry, TD 1,125 ft.

Fisher County: Noranda Oil Corp. 1 M. T. Beard, 99-1-H&TC, dry, TD 5,609 ft., reef 5,334 ft.

Jones County: Clark H. Boyles 1 J. O. Radford, 20-16-T&P, dry, TD 4,763 ft., Caddo 4,754 ft.

Payne-Johnson-Byars 1 Pittard, Sec. 27, OAL Sur., dry, TD 3,010 ft.

Keith Wells 1 W. S. Pope, Sec. 11, OAL Sur., dry, TD 3,755 ft.

Palo Pinto County: Trans-Gulf Corp. 2 R. W. McClure, Sec. 1,728, TE&L Sur., dry, TD 1,407 ft.

M. J. Keoughan 1 J. D. Doughty, John H. Carter Sur., A-234, dry, TD 3,700 ft.

Throckmorton County: P. M. Drilling Co. 1 E. P. Davis Estate, T&TRR Sur., A-877, dry, TD 4,519 ft.

Wichita County: Morgan Bros. 1 Tide Water-Sunray, Sec. 9, H&GN, dry, TD 2,005 ft.

Young County: B. F. Schultz 1 M. C. Wells, Sec. 734, TE&L Sur., dry, TD 2,603 ft.

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Texas Gulf Coast

Production Depth Records Due At Two Wildcats

HOUSTON.—Two tests drilled by Magnolia Petroleum Co. promise to establish the deepest production on the Texas Gulf Coast. In Colorado County, 3 miles northeast of Kennelly field, 1 Gracey-Wegenhoft recovered 6,000 ft. of gas-cut salt water on drill-stem test at 14,022-14,105 ft. Operators plan to come up the hole to test other shows indicated below 13,000 ft.

In Wharton County, Magnolia 1 Carl Reynolds, which is bottomed at 14,947 ft., re-tested perforations at 13,800-44 ft. and recovered salt water. A previous test recovered 800 ft. of gas-cut mud. Operators plan to test further up the hole above 13,000 ft.

Kirkwood & Morgan 1 W. A. Bell, DeWitt County dual strike, is scheduled to set casing at total depth of 8,115 ft. prior to conducting production tests. On drill-stem test in the Yegua at 5,067-78 ft., the well recovered 420 ft. of pipeline oil under working pressure of 70 psi. On drill-stem test of the Wilcox at 7,962-73 ft., recovery was 5,140 ft. of pipe-line oil and 644 ft. of salt water. This prospective discovery is located in F. R. McConnell Survey 2, Abstract 440, 3 miles northeast of Thomaston.

Two miles southwest of Tivoli, in Refugio County, Southern Minerals Corp. 1 Edwin Keller, wildcat, recovered 590 ft. of pipeline oil on 17-minute drill-stem test at 5,072-76 ft. Operator used ¼-in. chokes on the test. Another test at 5,026-80 ft. recovered 850 ft. of oil in 15 minutes. Bottom-hole pressure ranged from 1,800-2,100 psi. The sand thickness was estimated to be 20 ft. Operator is preparing to set 5½-in. casing to total depth of 5,080 ft. This apparent discovery is located in J. R. Tileston Survey, A-289.

Potential test has been run at Alex Head and Kirkwood 1 Stella Woytek, gas distillate discovery 3 miles northeast of Hallettsville in Lavaca County. From perforations in the Wilcox at 8,540-56 ft., the well flowed an estimated 9,000,000 cu. ft. of gas per day plus an estimated 125 bbl. of condensate per million cubic feet of gas. Discovery is located in James Campbell League 2, A-6.

TEXAS GULF COAST (DISTRICTS 2 AND 3) SUCCESSFUL WILDCATS

Galveston County: new pay at Hitchcock—Stewart Petroleum Co. 3 Fred Thomas et al, J. D. Moore League, TD 6,751 ft., perf. 4,602-08 ft., IP 44 bbl. oil per day, 7/64-in. choke, TP 1,540 psi., 28.1° gravity.

Washington County: new pay at Arthur Harvey—Tex Harvey Oil Co. 1 Robert

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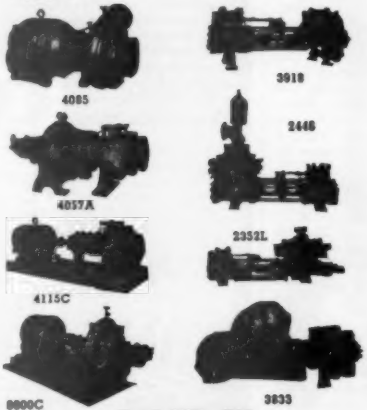

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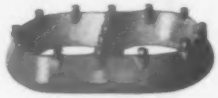

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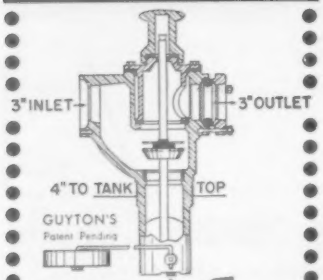

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Winkelmann, John H. Allcorn ¼ League, TD 10,184 ft., perf. Wilcox 8,720-23 ft., IP 5 bbl. oil per day, 40° gravity.

TEXAS GULF COAST (DISTRICTS 2 AND 3) WILDCAT FAILURES

Fort Bend County: Salt Dome Production Co. et al 1 George Armstrong, James Scott Sur., A-84, Sec. 3, dry, TD 6,037 ft.

Goliad County: Spartan Drilling Co. 1 B. Seiler, V. Hernandez Sur., A-16, dry, TD 8,015 ft.

Karnes County: Forney & Winn 1 J. R. Kyselica, Erasmo Sequin Grant, A-10, dry, TD 4,016 ft.

Live Oak County: Humphries & Ritchie 1 Lee Pope, E. A. Adams Sur., dry, TD 2,180 ft.

Montgomery County: F. A. Callery, Inc., 1 Rena R. Weisinger, William Atkins Sur. A-3, dry, TD 4,760 ft.

Victoria County: B. Schlosberg 1 J. J. Murph Est., Juan Flores Sur. A-29, dry, TD 6,000 ft.

Wharton County: K. D. Owen 1 Sally Westmoreland, Miguel Muldoon Sur. A-46, dry, TD 7,850 ft.

Mississippi

Final Completion Made At Jefferson Wildcat

JACKSON.—Final completion has been made at J. Willis Hughes 1 Logan-Shields, 20-8n-1w, Jefferson County, Mississippi. On potential test, the well flowed 80 bbl. of 29.2°-gravity oil daily through ⅛-in. choke under tubing pressure of 1,025 psi. Production is from jet perforations at 4,163-64 ft., in the Wilcox. On a drill-stem test of these perforations, the well started flow approximately 75 bbl. of oil daily under tubing pressure of 350 psi. There is some question as to why tubing pressure has increased to 1,025 psi. This new field has been named "Sunnyside."

In Baxterville field, Lamar County, Gulf Refining Co. is drilling ahead at 11,097 ft. at 25 Andrews, 6-1n-16w. No more shows have been encountered below the zone from which 3,063 ft. of 40.7°-gravity oil was recovered on drill-stem test at 10,829-70 ft.

Gulf Refining Co. 5 Crosby Lumber Co., 23-3n-2w, discovery well for Wilkinson field, Wilkinson County, is testing to tanks, but potential test has not been made. Latest gage released was the discovery was flowing 156 bbl. of 34.5°-gravity oil daily through 11/64-in. choke under tubing pressure of 220 psi.

Three and one-half miles southeast of production at Pollard field, Escambia County, Alabama, Humble Oil & Refining Co. is reported to be abandoning 1 Lovelace, 22-1n-9e at total depth of 6,581 ft. Although no details have been released on the venture, it is reported that the large fault in the area cut out the Eutaw section and the well ran low structurally.

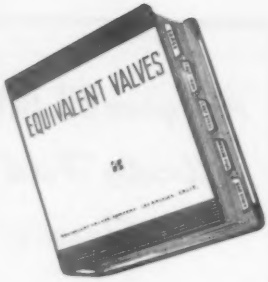
MISSISSIPPI SUCCESSFUL WILDCAT

Jefferson County: oil discovery "Sunnyside" —J. Willis Hughes 1 Logan-Shields, 20-8n-1w, TD 6,552 ft., Wilcox 4,163-64 ft., IP 80 bbl. oil per day, ⅛-in. choke, TP 1,025 psi., 29.2° gravity.

MISSISSIPPI WILDCAT FAILURES

Adams County: Humble Oil & Refining Co. B-1 R. L. Emery, Jr., 39-6n-1w, dry, TD 6,510 ft.

Franklin County: B. Serio 2 George Dickins, 9-5n-1e, dry, TD 6,806 ft.



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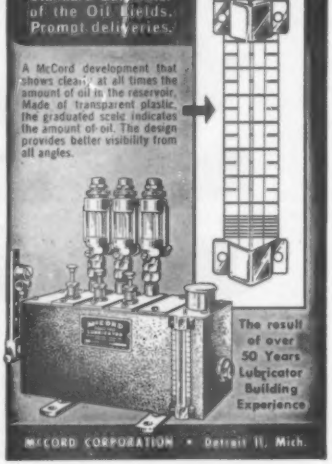

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Oklahoma

Ellis County Discovery Produces Gas-Distillate

THE northwestern Oklahoma portion of the Anadarko basin seems assured of another deep gas-distillate field, the third to be opened in that region within the past month. It is located in northern Ellis County, heretofore unproductive, where Carter Oil Co. is conducting production tests at its 1 Rosendale, C NW SE 22-23n-24n, 5 miles southeast of Chaney.

With casing perforated at 8,455-8,510 ft., opposite Morrow (basal Pennsylvanian) sand, the well flowed 25 bbl. of distillate with 2,170,000 cu. ft. of gas on a 15-hour gage through ¾-in. choke. Previous tests in Chester lime, opposite which casing was perforated at 8,607-35 ft., got only a small gas flow. Casing had been run through these zones to 8,711 ft. in hole drilled to 9,806 ft. Testing continues.

Location is 18 miles southeast of the gas-distillate discovery well completed early this month in Morrow sand by Sunray Oil Corp. at its 1 Wolfe, C NW NE 4-25n-25w, 3 miles south of Laverne, in Harper County. It is 55 miles northwest of the gas-distillate discovery well which Continental Oil Co. completed last month in Chester lime at its 1 Kimball, NW NW SW 34-20n-16w, northeast of Seiling, in southwestern Major County.

Testing is under way at Magnolia Petroleum Co.'s indicated Springer sand producer for the Southeast Bradley pool, Grady County. The indicated new well is 1 Sarah Addison, C SW NW 13-4n-5w, south offset to the discovery, and so far only producer in the pool. The discovery well, completed early this year, produces from the Hart sand, although prior to completion it produced a small amount of oil from the deeper Springer zone.

The Addison well, first test drilled since completion of the discovery well, was drilled to 10,425 ft. in the Springer section. Casing, run to 9,728 ft., has been perforated at 9,623-30 ft., opposite a zone from which 720 ft. of oil and 810 ft. of oil-cut mud had been recovered in a drill-stem test when the pay was drilled. An initial drill-stem test of the casing perforations yielded 2,000 ft. of oil, 100 ft. of oil-cut mud, and 600 ft. of drilling water.

Wilcox Oil Co. is opening a new lower Cleveland sand pool 5 miles southeast of Perry, in Noble County, where its 1 Carl, NE NE SW 17-20n-1e, flowed 80 bbl. of oil with 25 bbl. of water in 24 hours through 21/64-in. choke. Pay is open through casing perforations at 4,215-26 ft. with bottom of the hole at 4,828 ft.

In Lincoln County, Skiles Oil Corp. 1-A George Smith, NE SW NE 2-13n-3e, 5 miles southwest of Chandler, got 195 ft. of heavily oil and gas-cut mud in a 60-minute drill-stem test at 4,050-80 ft., the bottom 13 ft. being in Prue sand. Gas was at the surface in 8½ minutes. Casing has been run to 4,066 ft. Nearest production is in the small Southeast Warrick pool, 2½ miles to the northwest.

OKLAHOMA SUCCESSFUL WILDCATS

Harper County: Sunray Oil Corp. 1 M. Wolfe, C NW NE 4-25n-25w, flowed 47 bbl. oil from Morrow sand 7,190-7,230 ft., and 5,200 M.c.f. of gas, ID 8,245 ft. PBTD 7,271 ft.

Lincoln County: Gulf Oil Corp. 1 Henthorne Est., NE NW NE 1-12n-4e, flowed 195 bbl. of 38°-gravity oil from lower Skinner 4,090-4,114 ft., TD 5,390 ft. PBTD 4,149 ft.

McClain County: Woodward & Mendota 1 Effie May Conner, NE SE SW 11-7n-3w, flowed 720 bbl. of 39-3°-gravity oil from Bromide 9,236-96 ft., 264 bbl. of 39.1°-gravity oil from Joins 10,053-88 ft., TD 10,206 ft.

OKLAHOMA WILDCAT FAILURES

Caddo County: H. W. Snowden 1 Youngblood, SE SE NW 24-6n-10w, dry, TD 4,600 ft.

Cotton County: S. F. Hutcheson 1 Elsie H. Champion, SE NW NE 31-1s-11w, dry, TD 2,436 ft.

Garvin County: Phillips Petroleum Co. 1 Denson, SW SW SW 18-3n-3w, dry, TD 10,510 ft.

Grant County: Falcon Seaboard Drilling Co. 1 Enfield, NW NW SW 10-26n-6w, dry, TD 5,895 ft.

Logan County: Ashland Oil & Refining Co. 1 Kenady, SE SE NW 28-15n-1w, dry, TD 6,161 ft.

McClain County: Ashland Oil & Refining Co. 1 Caviness, C NW SE 27-6n-4w, dry, TD 13,066 ft.

Noble County: Wm. E. Eppler 1 Clifton, SW SW NE 29-22n-2e, dry, TD 4,625 ft.

J. R. Porter 1 Barkley, NW SW NE 19-24n-3e, dry, TD 1,612 ft.

Okfuskee County: Manahan Oil Co. 1 Fletch-

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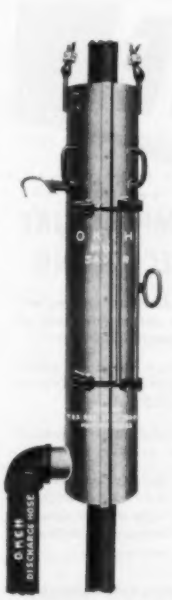

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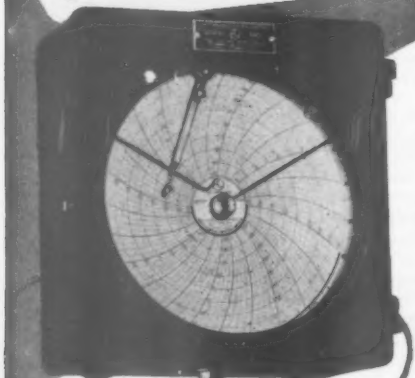

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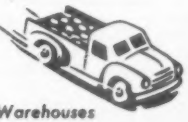

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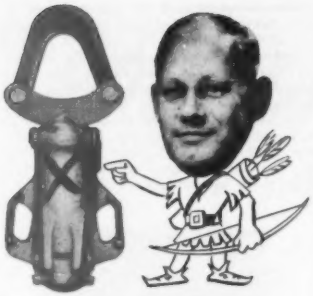

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er, NW NW NE 17-13n-8e, dry, TD 3,712 ft.

Osage County: Chas. W. Oliphant 1 Osage, SW SW SE 28-25n-4e, dry, TD 3,737 ft.

Stephens County: Eason Oil Co. 1 Brown, NE NW NE 29-2s-4w, dry, TD 3,671 ft. J. H. Buchanan 1 Brennan, SW NE NE 22-1n-4w, dry, TD 7,395 ft.

Eastern Texas

Northern Area Announces Four New Prospectors

DALLAS.—The northern portion of East Texas was in line for four prospectors, in as many counties. A Penrod Drilling Co. rig was said to be moving in to drill H. L. Hunt 1 O. Bamburg, 9,000-ft. wildcat about 3½ miles southwest of the town of Como in the Winney Jewell Survey, of Hopkins County.

Also in Hopkins County, Empire Drilling Co. 1 O. P. Gorman has been scheduled to 8,500 ft. Location in the J. G. Weems Survey is 5 miles northwest of Winnsboro.

In Titus County, B. G. Byars and others' 1 C. H. Wilson will be a 5,000-ft. test 7 miles east of Talco, in the R. W. Pittman Survey.

B. G. Byars has applied for permit to drill 1 Paul Pewitt as a 4,600-ft. wildcat in Morris County, 8½ miles north of the town of Omaha, in the G. Dyer Survey.

On the east side of Sherman, Grayson County, and within the townsite, Arthur Willingham 1 Raymond Ridge completed on the pump for 190 bbl. of 27°-gravity oil a day. Pay was from perforations at 3,142-58 ft.

Star Oil Co. 1 R. M. Brooks, wildcat 3 miles northeast of Sadler, was dry at 8,624 ft., with no shows.

Southeast of Emory in Rains County, Shell Oil Co. 1 Prince, J. Forsythe Survey, was drilling at 11,177 ft.

EAST TEXAS (DISTRICTS 5 AND 6) SUCCESSFUL WILDCATS

Marion County: Keemp Drilling Co. 1 Reed & Bitner, Mason & Shoemaker Sur., NW of gas-distillate production in Woodlawn field, TD 6,654 ft., elev. 215 ft., Pettit pay 6,566-72 ft., IP 317 bbl. 44°-gravity oil, 14/64-in. choke, TP 750 psi., GOR 701 cu. ft.

Wood County: Trans-Tex Drilling Co. 1 R. F. Walker, W. R. Buckley Sur., TD 4,578 ft., elev. 431 ft., sub-Clarksville pay 4,520-34 ft., IP pumped 123 bbl. 16°-gravity oil.

EAST TEXAS (DISTRICTS 5 AND 6) WILDCAT FAILURES

Anderson County: Bobby Manziel 1 Anderson County, Anderson CSL Sur., dry, TD 4,820 ft.

Bowie County: American Liberty Oil Co. 1 C. D. Heard, T&PRR Sur., dry, TD 4,397 ft.

Denton County: D. H. Bolin 1 P. R. Cherry, S. Noling Sur., A-968, dry, TD 2,300 ft.

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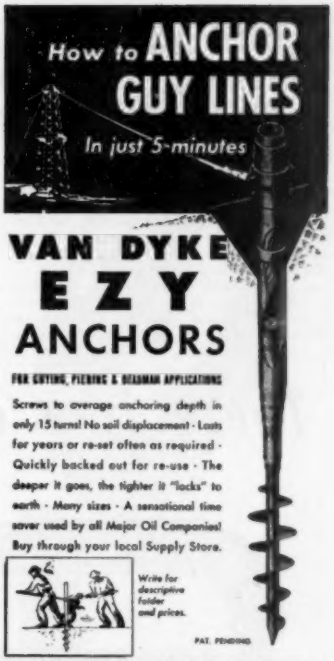
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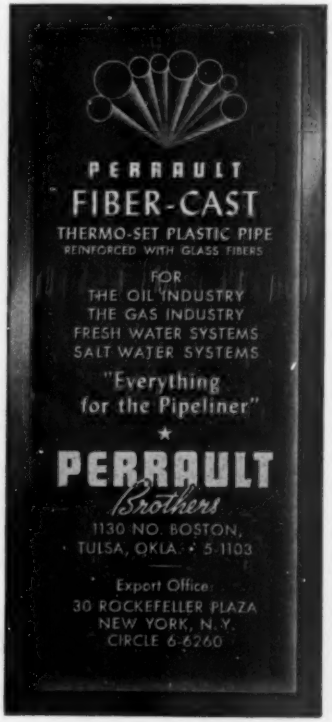

Appalachian-Ohio

Small Chert Gas Well Completed in Maryland

PITTSBURGH. — Garrett County, Maryland: Cumberland & Allegheny Gas Co., completed Jasper Riley gaging 18,000 cu. ft. gas, chert 2,863 ft., gas 2,886-2,909 ft., TD 3,109 ft. Eberly & Snee 3 Gordon, elevation 2,509 ft., reached the Onondaga at 3,778 ft., and is shut down at 3,793 ft., to run casing. Mid Atlantic Oil & Gas Co. 1 B. & O. R. R. Co., has a show of gas in the Onondaga at 3,672 ft., and is drilling at 3,674 ft. No. 2 Oren T. Graser elevation 2,386 ft., recorded the Tully at 2,686 ft., Onondaga at 3,236 ft., and is shut down at 3,250 ft. Loch Lynn Corp. 1 Lester White, elevation 2,402 ft. is shut down at 3,554 ft., in the top of the Oriskany sand with gas testing 100,000 cu. ft.

Southwest Pennsylvania . . . Unity Township, Westmoreland County: Peoples Natural Gas Co. 4003 A. J. Dotterway, elevation 2,094 ft. is shut down at a depth of 8,145 ft. 4008 J. R. Frola, drilling at 840 ft.

MARYLAND SUCCESSFUL WILDCAT

Garrett County: Cumberland & Allegheny Gas Co. 1 Jasper Riley, 18,000 cu. ft. gas, chert 2,863 ft., gas 2,886-2,909 ft., TD 3,109 ft.

OHIO

B. H. Putnam 1 Russel Randolph, Section 11, Olive Township, Meigs County, a wildcat 4 miles south of 1 J. C. Wilson, made a small showing of gas natural from Oriskany sand at 4,215-4,242 ft. The well was Hydrafracked and the open flow increased to 200,000 cu. ft. It was then shot with 40 qts., but showed no further increase, and it is now being tested.

The Mid East Oil Co. 1 Homer Thompsrn, Section 18, Jackson Township, Knox County, after producing for a short time natural, was shot with 120 qts. and made 80 bbl. in 24 hours with a gage of 520,000 cu. ft. gas.

OHIO WILDCAT FAILURE

Medina County, Wadsworth Township: Ohio Fuel Gas Co. 1 Paul Lichty, Lot 21, Clinton 3,428-92 ft., TD 3,516 ft.

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Kansas

Oil String Run to Test Lane County Discovery

OIL string has been run for production tests at Hugoton Production Co.'s rank wildcat test in the north central part of Lane County in the upper end of the Hugoton embayment, in far western Kansas. The test, 1 Flo, NW NE SW 19-17-29, 7 miles northwest of Dighton, has prospects of production in both the Lansing and the Marmaton zones. Hole has been deepened into the Mississippian, topped at 4,206 ft. Total depth is 4,709 ft.

Best indications of production were in the Marmaton zone, in which a 60-minute drill-stem test at 4,535-57 ft. recovered 720 ft. of oil and 60 ft. of oil-cut mud with a bottom-hole pressure of 1,100 psi. A previous test in the Lansing at 4,401-24 ft. got 180 ft. of oil and 615 ft. of heavily oil-cut mud.

Location of the indicated oil discovery is more than 12 miles from nearest production, the recently opened Jasper pool, 12 miles to the north in southern Gove County.

Continental Oil Co. has completed its 1 Feely, SE SE SW 2-5-27, opening a new Lansing lime pool in southeastern Decatur County. The well established a pumping potential of 754 bbl. of oil per day and showed no water. Production is from casing perforations at 3,583-97 ft., 3,609-14 ft., and 3,621-32 ft. Total depth is 4,043 ft., plugged back to 3,633 ft. Location is 2 miles north of the company's recently opened Hardesty pool, and 3 miles southwest of the Jennings pool, opened by The Texas Co. late in 1951.

Nadel & Gussman 1 Bredfeldt, SE NE SE 24-18s-10w, a wildcat between the Orth and Bredfeldt pools, in northwestern Rice County, is being put on the pump for completion after swabbing tests, in which it produced at the rate of 30 bbl. of oil per hour. Production is from open hole at 3,229-28 ft. in Arbuckle lime.

Amerada Petroleum Corp. has an indicated Viola lime producer at its 1 Richardson, NE NE NE 22-27-10, northwestern Kingman County wildcat. Viola was logged at 4,318 ft. A 2-hour drill-stem test at 4,315-23 ft. got a gas flow estimated at 200,000 cu. ft. per day, and filled 2,400 ft. of oil and 360 ft. of water. Casing has been run. Location is ¾ mile west of the Dresden pool but there is a dry hole between it and production.

A new producing area, located 5 miles northwest of Pratt and 2½ miles southeast of the Iuka-Carmi field, in Pratt County, is indicated by oil showings encountered by Lindas Oil Co. at its 1 Allen, NW NW SE

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21-27s-12w. Showings were in the Lansing-Kansas City lime section, topped at 3,703 ft. A 45-minute drill-stem test at 3,942-76 ft. got 2,460 ft. of gas and 195 ft. of oil and gas-cut mud. Hole is being deepened to its Arbuckle objective before testing.

Two miles west of the Solomon pool in northwestern Ellis County, National Cooperative Refinery Association 1 Ginther, NE NE SW 17-11-19, pumped 111 bbl. of oil with 4 bbl. of water in 24 hours on a potential test, opening another producing area. Pay is in the Lansing-Kansas City lime, open at 3,555-58 ft.

KANSAS SUCCESSFUL WILDCATS

Rice County: C. E. Skiles 2 Boldt, CEL NW NE 9-19s-10w, 427 bbl. of oil from Arbuckle 3,334-40 ft., TD 3,349 ft. (new pay in IXL South).

Trego County: Wick 1 Neiden, SE SE SW 16-12s-23w, pumped 42 bbl. of oil from Lansing-Kansas City 3,830-34 ft., TD 4,367 ft. (opens Neiden pool).

KANSAS WILDCAT FAILURES

Barton County: Ben Brack 1 Flanders, NW NW NW 2-19s-13w, dry, TD 3,385 ft.

Chase County: P. L. Edwards 3 Crosby, NE NE SW 23-22s-9e, dry, TD 2,448 ft.

Dickinson County: J. Desbrow 1 Garvie, CSL N½ SW 2-13s-1e, dry, TD 3,091 ft.

Graham County: Herndon Drilling Co. 1 Keith, NW NW SE 24-7s-25w, dry, TD 4,387 ft.

Palmer 1 Robinson, NE NE NE 17-9s-23w, dry, TD 4,300 ft.

Musgrove 1 Wolfe, SE SE SW 18-10s-25w, dry, TD 4,550 ft.

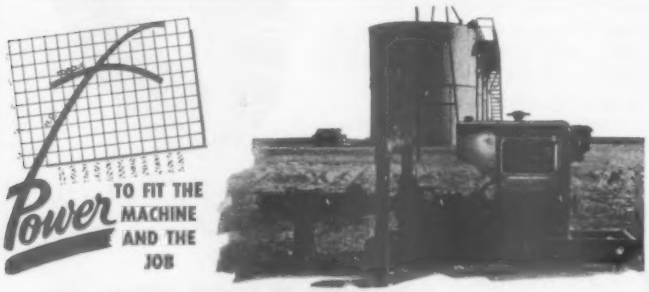
Greenwood County: White & Ellis 1 Noffsinger, SW NW SW 3-22s-11e, dry, TD 2,045 ft.

Phillips County: Lewis Drilling Co. 1 Merklein "A," NE NE SE 16-3s-19w, dry, TD 3,425 ft.

Pratt County: M. B. Armer 1 Long, NW NW NE 16-26s-12w, dry, TD 4,420 ft.

Trego County: Deep Rock Oil Corp. 1 Nicholson, SW SW SW 29-13s-22w, dry, TD 4,535 ft.

GMR 1 Moore, SE SE NE 35-14s-21w, dry, TD 3,904 ft.



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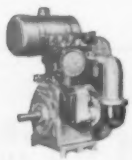
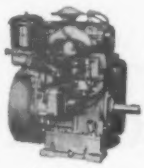
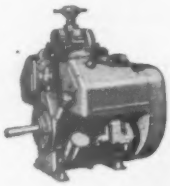

Single cyl.
3 to 9 H.P.


2-cylinder
7 to 13 H.P.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Central Area

MICHIGAN

Flowing at the rate of 14 bbl. of oil an hour through a restricted, ½-in. choke, after acid treatment with 2,000 gal. in the Richfield, Brazos Oil & Gas Co. appeared to have an important extension to Rose City field, and one of the biggest, if not the biggest, Richfield oil producer drilled to date in Michigan. This new well, located approximately 2½ miles west and north of the closest producer in the Rose City pool, was the Brazos Oil & Gas Co. BBB-5 State-Foster, N½ NW SE 21-24n-1e, Foster Township, Ogenaw County. Well was bottomed out in the Richfield at 4,294 ft. Section from 5-in. casing point, 4,178 ft., to the total depth was acidized. Flowing tubing pressure was reported at from 125-200 lb., while casing pressure was reported to be holding at about 600 lb. Well was tested natural earlier in the week and production was reported to have averaged 42 bbl. of oil in 14 hours, swabbing and flowing.

The bulk of the acreage around this major extension to the Rose City pool is controlled by Brazos, but both Sun Oil Co. and The Superior Oil Co. have important spreads of acreage within the shadow of this producer which may be proved up for development with the completion of only a very few more wells in this area.

It was expected that the Sun Oil Co. would have production gages after acid treatment by early next week at company's 1 Tutzi et al, NW SW SW 5-19n-3w, Hamilton Township wildcat, Clare County, which showed up to 3,000 ft. of oil from the Richfield on a drill-stem test run at 5,126-5,239 ft. for 5½ hours. Hole was being plugged back with cement and lead wool this week from 5,380 ft., TD, in an attempt to shut off water which showed in the bottom of the hole.

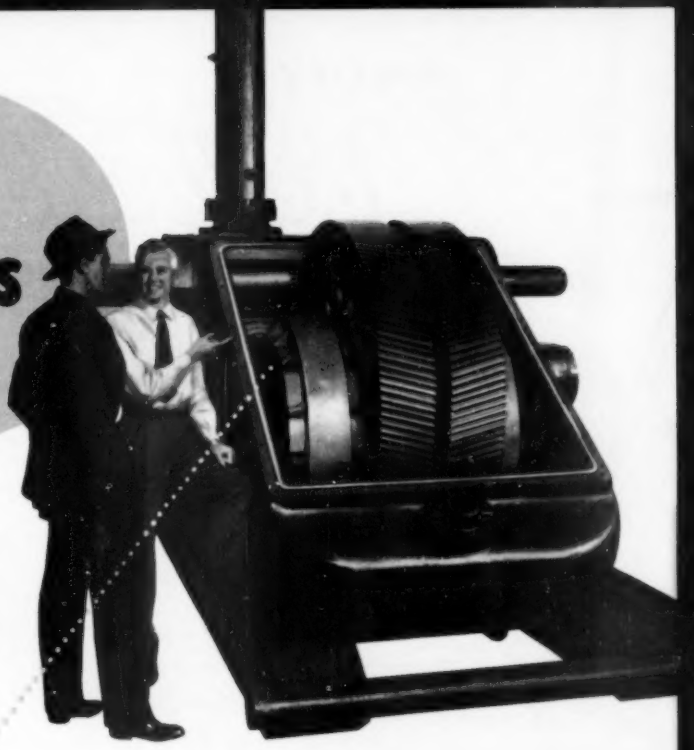
INDIANA

C. E. O'Neal and associates have extended production in the Owensville area of Gibson County more than a half mile at their 1 Smith-Baird, SE SE SE 24-3s-12w. The new discovery, being completed in O'Hara lime, with casing perforated opposite intervals at 2,510-17 ft. and 2,520-26 ft., pumped at the rate of 6 bbl. of oil per hour. Previously it swabbed and flowed more than 390 bbl. of oil in 17 hours. Total depth of the hole is 2,569 ft. with casing on bottom. The new extension area is approximately 3 miles south of Owensville.

EASTERN KENTUCKY

On the Wyatt dome in extreme western Elliott County, Raymond Long et al are drilling at 1,315 ft. at 1 Neely Gray. This wildcat topped Corniferous lime at 1,299 ft. and had small show of gas at 1,304 ft. Drill-

for heavy mud pump loads **BRONZE BEARINGS** are best!



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ing is being continued to the Silurian Big Six sand.

In Greenup County and west of Oldtown, Van Everman et al are drilling at 1,025 ft. on their ¾-mile east outpost to recently discovered Coniferous production in the southeastern portion of the county. A good show of oil was had in the Berea formation at 700 ft.

WESTERN KENTUCKY

J. R. Powell and associates have a prospective Tar Springs producer at their 1 Blair, a wildcat located in 11-N-24, 2 miles from other production in the Sebree area of Webster County. The well filled 1,020 ft. of oil and 60 ft. of oil-cut mud in 67 minutes during a drill-stem test of saturation logged at 1,735-45 ft. Bottom of the hole at 1,745 ft. still is in the pay. Casing has been run to the top of the interval. Location is a mile northeast of the town of Sebree.

Union County also has a new oil discovery, located 2 miles northeast of Uniontown in 7-P-20, where George S. Engle found good saturation in both the Aux Vases and McClosky zones at his 1 Union Bank & Trust Co., in 7-P-20. A 2-hour drill-stem test in the Aux Vases at 2,496-2,500 ft. got gas in 35 minutes and recovered 200 ft. of clean oil. A similar test in the McClosky at 2,559-61 ft. got 440 ft. of gas and 40 ft. of oil-cut mud. No water appeared. Hole is bottomed at 2,663 ft. with casing run through the above zones to 2,600 ft. Location is a mile from nearest production.

Sun Oil Co. 1 Byrne, in 14-O-26, near Green River, 5 miles south of Hebbardsville, in the southwest corner of Daviess County, near the Henderson County line, is estimated good for 35 bbl. of oil per day as a new discovery well in Benoist sand at 1,988-2,000 ft. It is 2 miles from other production.

ILLINOIS

A new producing area, located 1½ miles from other production, appears to have been discovered in Lawrence County by Coy Oil Co. and Bury Drilling Co. at their 1 Prout, SE SE SW 12-2n-13w. Good indications of production were found in two horizons, the O'Hara lime and upper McClosky. Promising oil showings also were present in the shallower Benoist sand.

O'Hara saturation was logged at 2,353-60 ft., and in a drill-stem test of that interval, the well gassed in 5 minutes and after 20 minutes started flowing clean oil. Five feet of upper McClosky pay also was tested at 2,380-85 ft., getting gas in 3 minutes and flowing clean oil in 5 minutes. Benoist sand was tested at 2,181-2,231 ft., getting 120 ft. of gas, 10 ft. of oil and 10 ft. of mud-cut oil in 3 hours and 45 minutes.

Hole was drilled to 2,438 ft. in the lower McClosky and casing run through the section to bottom for production tests.

The new area is about 2 miles southwest of Lawrenceville.

Magnolia Petroleum Co. has completed an exceptionally good Aux Vases producer in Roland field, 3 miles southeast of Norris City, in White County. Its 5 General American, NW SE SW 1-7s-8e, originally completed as a small pumper in Tar Springs sand at 2,231 ft., was deepened to 3,156 ft., where a liner string was run and perforated at 2,963-69 ft., in the Aux Vases zone, from which the well flowed 736 bbl. of oil in 24 hours.

Markay Oil Co. 1 Cleveland, NW NE NE 24-4s-10e, an outpost test for the Phillipstown Consolidated pool, in the area a mile east of Crossville, White County, swabbed 2 bbl. of oil per hour in production tests of Tar Springs sand at 2,343-50 ft., and is being put on the pump.

ILLINOIS WILDCAT FAILURES

Bond County: C. J. Simpson 1 Potthast, Jr., SE SE NW 29-4n-4w, dry, TD 2,245 ft.

Clark County: Sun Oil Co. 1 M. Wernz estate, SW SE NW 15-11n-11w, dry, TD 2,393 ft.

Clay County: E. A. Obering 1 McGrew, NE NE SW 17-3n-5e, dry, TD 2,874 ft.

Douglas County: Walter Henigman 1 Armstrong, SE SW SW 30-16n-14e, dry, TD 383 ft.

Perry County: G. S. Engle 1 Mayer, SE NE SW 22-5s-4w, dry, TD 2,662 ft.

White County: H. Schide 1 Jennings, NE NE NE 15-6s-8e, dry, TD 3,315 ft.

INDIANA WILDCAT FAILURES

Gibson County: Joe Bander 1 Martin, NW NE SW 8-3s-10w, dry, TD 2,267 ft.

Knox County: Cline & Lambert 1 Kuhn, Nc Location 65-2n-9w, dry, TD 1,670 ft.

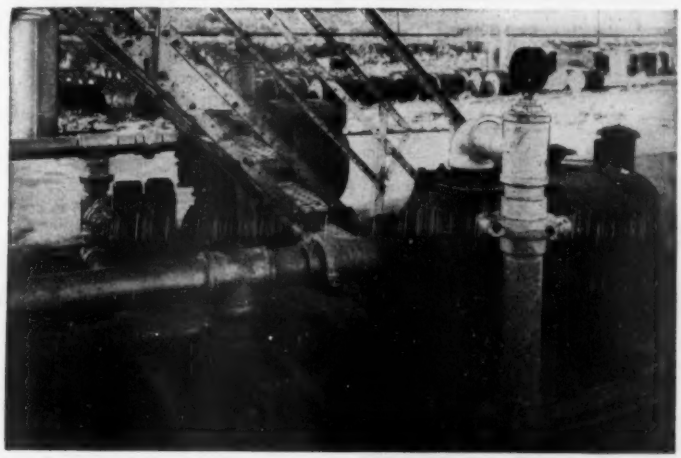
Posey County: Paul Rossi 1 Ver Wayne, SE SE NW 33-6s-14w, dry, TD 2,877 ft.

Sullivan County: Kuhn & Banks 1 Larr, SE NE NE 9-9n-8w, dry, TD 2,010 ft.

Vigo County: T. & H. Corp. 1 Green-McCullough, NE NW NW 35-11n-8w, dry, TD 1,910 ft.

WESTERN KENTUCKY WILDCAT FAILURES

Henderson County: Indiana Farm Bureau 1 Cooper, NW SE SE NW 11-Q-20, dry, TD 2,796 ft.



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R. E. Stouder et al 1 Agnew, SE NE NW SE 23-Q-25, dry, TD 2,269 ft.
R. E. Hupp et al 1 Eblen, N½ SE SE SE 21-Q-24, dry, TD 2,425 ft.

Ohio County: F. J. Zogg et al 1 Basham, SEc SE SE SW 11-L-33, dry, TD 683 ft.

Webster County: W. F. Lacy et al 1 Robards, E½ SE SW SE 8-N-24, dry, TD 2,594 ft.

MICHIGAN WILDCAT FAILURES

Allegan County, Allegan Township: Sheldon-Stewart Co. 1 Clark, SE NE SE 15-2n-13w, Traverse 1,428 ft., dry, TD 1,463 ft.
Heath Township: P. K. Degenther F-1 U.S.A., NW NW NW 14-3n-14w, Traverse 1,557 ft., dry, TD 1,604 ft.

Van Buren County, Columbia Township: Harris Oil Co. 1 Kotelensky, SW SW SE 26-1s-15w, Traverse 1,139 ft., dry, TD 1,144 ft.
Geneva Township: Norman L. Stevens 1 Kraus, SE NW NE 16-1s-16w, Traverse 1,068 ft., dry, TD 1,081 ft.

Rocky Mountain

Cedar Creek Well Producing From Five Pay Zones

DENVER.—Shell Oil Co.'s north extension in the Cedar Creek area of Dawson County, Montana has had further tests, and Shell has estimated the well's potential at 6,700 bbl. per day from five Devonian-Ordivician pay zones.

Already rated as the biggest producer in the Williston basin to date, on the basis of previous tests, the official estimate makes the well the unquestioned leader in the basin.

Previously reported tests of 2,200 and 3,500 bbl. per day were followed by tests of additional intervals. Perforations from 9,105-49 ft. flowed at the rate of 475 bbl. per day through ½-in. choke. The zone 9,149-55 ft. was then perforated, was last reported flowing to pits with no gage.

The Shell success, 34-26-G, NW SW SE 26-15n-54e has fired already high interest in the area, and the Cedar Creek portion of the Baker-Glendive anticline promises to be one of the most active in the entire basin during coming months. The Texas Co. has started operations on six Cedar Creek wells, majority of which are prospectors.

The general increase widely predicted for both the Montana and North Dakota portions of the Williston is expected to materialize rapidly, due to removal of ban on transportation of heavy equipment on North Dakota highways. The annual embargo on such movements is imposed during the spring thaw period, is reported to have caused some operators considerable delay.

In the East Poplar area of Roosevelt County, G. H. Murphy, Jr. of El Dorado, Ark., has staked a fourth venture at the 4 Unit, C SW NE 33-29n-51e. He has had a discovery and a duster since entering operations in the area.

Ajax Oil Co. of Billings, reported to have good shows in the West Poplar area at 1 McGowan, C SE SW 10-29n-50e is testing at total depth of 6,213 ft. with no data released. The operation is a tight hole, is of interest because of Carter Oil Co.'s recent failure in the general area.

In North Dakota, Amerada Petroleum Corp. continues to test Madison at the Croff area wildcat 1 Risser, C SW SE 12-149n-96w in McKenzie County. It is the southernmost producer along the Nesson anticline. Drilling to the east of the Nesson area has produced no shows of merit, although several operations are in progress.

In Wyoming Gulf Oil Co. has tested the 1 Stockham-Federal, C SE NW 2-46n-94w, southwest of Worland in Washakie County for a flow of 4,760,000 cu. ft. gas per day, with 384 bbl. of 46.8°-gravity distillate. Test followed acidization of Phosphoria. Tubing pressure during the 24-hour test was 2,450 psi., and Gulf is installing high pressure separator prior to further tests. The wildcat is an important member of a series toward the central portions of the Big Horn basin.

First well to go to Tensleep in the area south of Hatfield field in Carbon County will be drilled by G. H. Vaughan Production Co.

Rocky Mountain Maps

Sectionized production maps showing oil fields in green, gas fields in red with official field names. Sections, townships, ranges and county seats. Drilling wells and dry holes with total depths.

Williston Basin — Size, 42" x 48". Scale, 1" = 10 miles. Prices: Paper, $30.00; Linen, $37.50.
Denver-Julesburg Basin — Size, 30" x 38". Scale, 1" = 8 miles. Prices: Paper, $20.00; Linen, $25.00.
North Dakota — Size, 52" x 74". Scale, 1" = 5 miles. Prices: Paper, $30.00; Linen, $37.50.
East Montana — Size, 54" x 56". Scale, 1" = 5½ miles. Prices: Paper, $28.00; Linen, $35.00.
South Dakota, Nebraska, West Montana, Wyoming, Colorado, Utah, Kansas and Oklahoma. Folder sent on request.

E. C. Jacobson
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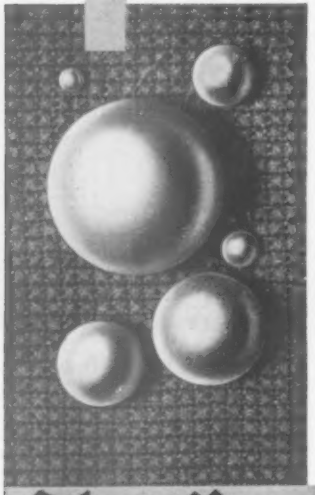
IN Size and Spherical Accuracy
Perfection of Surface
Uniformity—Dependable Physical Quality



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of Dallas. A deal with Sinclair turned the Dad area wildcat 1 Unit, SW NE NW 11-15n-91w over to the Dallas firm for deepening. The wildcat was abandoned last year at 8,805 ft., will be taken to Tensleep at about 10,500 ft.

Three new wildcats have been located in the Uinta basin of Utah. The basin has assumed considerable importance as a possible source of replacement for decreasing California production. Two California firms are involved in the new program. Union Oil Co. of California has taken a farmout from Carter, will drill in C SW SW 35-3s-11w. Carter has had two failures on the unit. Carter will drill 1 Moon, C SW SE 8-4s-3w in the Antelope Creek area of Duchesne County, east of Duchesne pool production, and The California Co. has staked 1 Unit, C NE NE 24-6s-4w also in the Antelope Creek area.

British-American Oil Producing Co. has an apparent "D" sand discovery at 1 Smithe, SW SW SW 29-12n-52w in Logan County, Colorado, north of production in the West Peetz area. Drill-stem test of the zone 5,127-42 ft. flowed gas at the rate of 3,200,000 cu. ft. per day, with a fine oil spray at the surface in 40 minute. The operator is continuing test.

WYOMING WILDCAT FAILURE

Goshen County: E. L. McElroy et al 2 Carpenter Broadbent, C SW SE 8-26n-60w, dry, TD 6,038 ft. "M" sand 6,004 ft.

COLORADO SUCCESSFUL WILDCAT

Adams County: Roden, Darden & McRae 1 Middlemist, NE NE SW 20-2s-57w, pumped 92 bbl. of oil per day, TD 5,892 ft. Pay sand 5,521-33 ft., 5,611-29 ft.

COLORADO WILDCAT FAILURES

Morgan County, Jackpot area: Shell Oil Co. 1 Wulf, NW NE NW 15-6n-58w, dry, TD 6,854 ft. Morrison 6,808 ft.

Lion Oil Co. 1 Thomas, SE SE SW 28-6n-58w, dry, TD 6,598 ft. Morrison 6,434 ft.

Weld County: Pure Oil Co. 1 State, C NW NW 12-5n-62w, dry, TD 7,201 ft. Morrison 7,105 ft.

Sligo area: Pure Oil Co. 1 H. Duell, SE SE SW 1-8n-61w, dry, TD 7,524 ft. Morrison 7,523 ft.

MONTANA SUCCESSFUL WILDCAT

Big Horn County, Toluca area: Couch Drilling Co. 1 Crosby, C NE NW 22-1s-31e, IP 40 M.f.c. of gas, TD 1,040 ft.

MONTANA WILDCAT FAILURES

Choteau County, Floweree area: United Petroleum Co. 1 Good, C NE NE 13-23n-4e, dry, TD 3,795 ft. Cambrian 3,790 ft.

Hill County, Havre: The Texas Co. 1 Kress Long, C SW SW 20-33n-15e, dry, TD 4,184 ft., Madison 3,952 ft.

Powder River County, Biddle area: Gulf Oil Corp. 1 Boyle, SW NW SE 4-8s-52e, dry, TD 9,062 ft. Deadwood 9,044 ft.

WESTERN NEBRASKA WILDCAT FAILURES

Cheyenne County, Cook area: Ohio Oil Co. 1 Planck, NE NE NE 26-15n-48w, dry, TD 4,519 ft., third sand 4,504 ft.

Morrill County: Carl Brazell and Ted Weiner et al 1 Dove, NW NW NE 3-21n-49w, dry, TD 4,169 ft. "J" sand 4,030 ft.

Rust-Oleum Corp. Names Distributors

Rust-Oleum Corp., Evanston, Ill., has announced the addition of five new industrial distributors to its distributor sales organization throughout the country. New firms appointed are: The Adkins Co., Berlin, Md.; Mill & Contractors Supply Co., Wilmington, N. C.; The Warren Hardware Co., Warren, Ohio; American Radiator & Standard Supply Corp., Zanesville, Ohio, and Couch & Heyle, Peoria, Ill.

Norvell-Wilder Reelects Carothers as President

Frank S. Carothers of Houston was recently reelected president and general manager of Norvell-Wilder Supply Co. by the board of directors.

At the same meeting Eugene T. Thompson was reelected vice president and secretary, E. W. Gildart, vice president, and Frank A. Douglas, treasurer. Douglas was also named assistant secretary and was elected to the board of directors.

In addition to the above officers, who are also members of the board of directors, the stockholders reelected the following directors: Mrs. Mildred Yount Manion, W. Cape Grant, Will E. Orgain, J. H. Phelan, Sr., Max Schlicher, and Elmo Beard.

DIAMONDS
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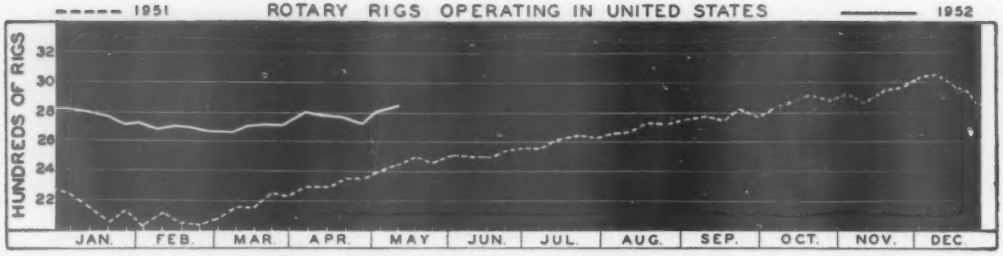
Other Offices-Services: Tyler, Texas ..... 2-2742; Shreveport, La. .... 5-5474; Odessa, Texas .... 6-6774; Casper, Wyo. ..... 3739; Abilene, Texas .... 2-2790; Carmi, Ill. ..... 7799; Victoria, Texas ..... 3264; Ft. Morgan, Colo. .... 1143; Norman, Okla. ..... 4360; Great Bend, Kans. .. 7585

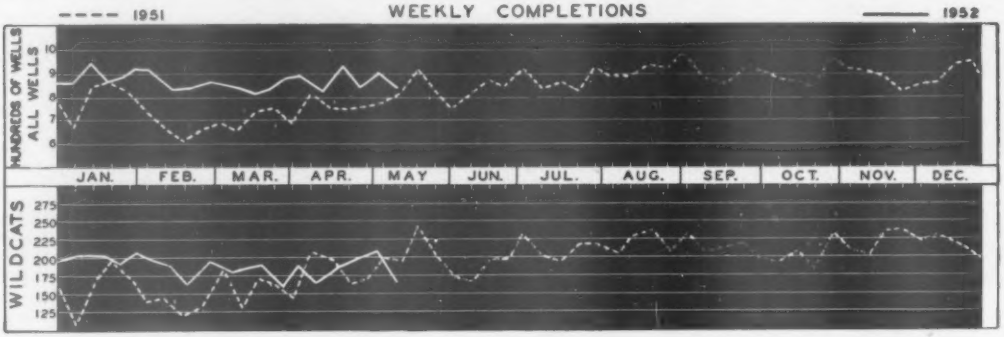
Distributors: Diamond Drilling Co., 2759 E. Willow St., Long Beach, Calif., Telephone: Long Beach 40-7949; Allied Services, Inc., Mt. Pleasant, Michigan Telephone: 29-861

Foreign: D. T. O'Connor, 500 Fifth Avenue, New York, N. Y.; Petroleum Industry Consultants, C. A., Caracas, Venez.; Denton - Spencer Co., Ltd., Calgary, Alberta, Canada.

THE OIL AND GAS JOURNAL

"Shut that door! Do you want the whole East Texas pool to go out the window?"





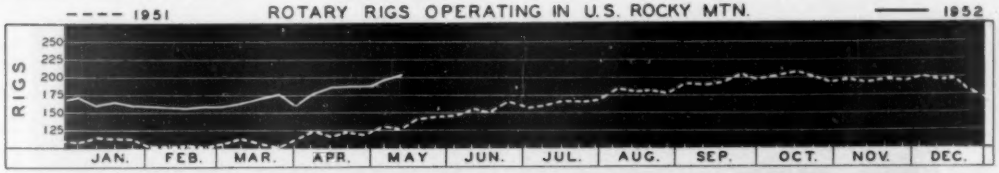
CURRENT STATISTICS

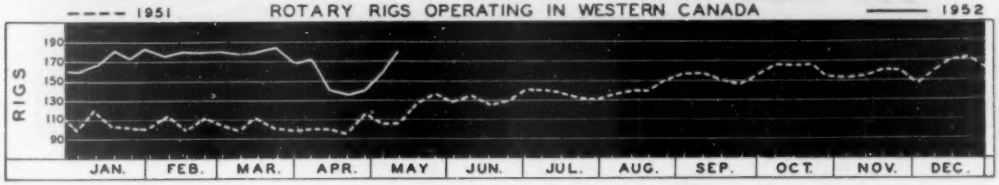
EXPLORATION

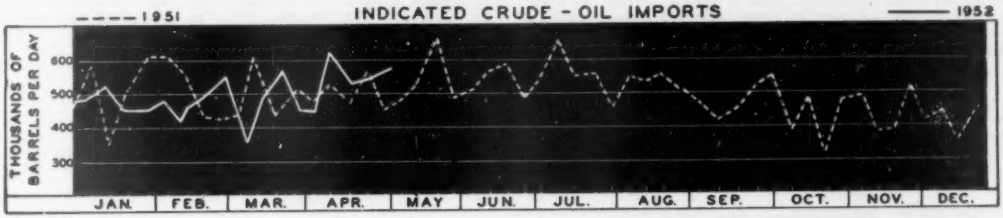
WEEKLY WELL COMPLETIONS . . . WEEK ENDED MAY 10, 1952

	Total of all wells					May 10		Wildcat completions and discoveries					Cumulative total, 1952				
	Comp.	Oil	Gas	Dry	Footage	1952	1951	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	18	9	0	*9	24,000	227	90	0	0	0	0	0	0	0	0	0	0
Pennsylvania	38	16	6	†16	77,660	598	266	0	0	0	0	0	0	0	0	2	2
West Virginia	13	2	9	2	38,636	240	199	0	0	0	0	0	0	0	2	1	3
Ohio	20	7	5	‡8	47,670	318	273	0	0	0	1	1	0	0	5	3	8
Indiana	20	7	0	13	38,347	378	335	0	0	0	5	5	14	0	2	112	128
Kentucky	27	8	4	15	49,484	438	302	0	0	0	5	5	9	0	0	74	83
Illinois	31	14	0	17	67,504	515	577	0	0	0	6	6	7	0	0	132	139
Michigan	14	4	0	10	31,033	243	236	0	0	0	4	4	10	0	1	87	98
Kansas	81	40	11	30	263,136	1,722	1,452	2	0	0	11	13	32	0	5	286	323
Nebraska	7	3	0	4	28,618	88	102	0	0	0	4	4	4	0	0	48	52
Oklahoma	107	56	2	‡49	437,991	2,196	1,968	3	0	0	13	16	38	1	7	229	275
Texas	300	191	17	92	1,419,931	6,453	5,781	18	0	1	49	68	297	27	48	1,348	1,720
North Central (Dist. 7-B & 9)	78	46	1	31	263,076	1,970	1,760	9	0	0	14	23	170	1	14	572	757
West (Dist. 7-C & 8)	101	80	0	§21	566,637	1,999	1,783	3	0	0	11	14	52	0	3	231	286
Panhandle (Dist. 10)	19	7	10	2	56,319	256	250	0	0	1	1	2	1	0	3	20	24
Eastern (Dist. 5 & 6)	17	9	3	5	96,594	340	402	2	0	0	4	6	12	3	0	78	93
Gulf Coast (Dist. 2 & 3)	46	32	2	12	266,987	971	802	2	0	0	7	9	38	15	12	191	256
Southwest (Dist. 1 & 4)	39	17	1	‡21	170,318	917	784	2	0	0	12	14	24	8	16	256	304
Louisiana	35	20	3	12	280,017	795	692	0	1	0	5	6	14	7	4	88	113
Northern	13	6	1	6	49,820	427	337	0	0	0	1	1	6	0	4	37	47
Southern	22	14	2	6	230,197	368	355	0	1	0	4	5	8	7	0	51	66
Arkansas	9	2	0	7	35,813	136	129	0	0	0	2	2	4	0	0	21	25
Mississippi	4	1	0	3	26,672	138	92	1	0	0	2	3	7	1	1	52	61
Southeastern States	1	1	0	0	5,982	18	29	0	0	0	0	0	1	0	1	10	12
Montana	18	8	1	9	50,671	79	72	0	0	1	3	4	2	0	1	20	23
Wyoming	7	4	0	3	29,444	229	235	0	0	0	1	1	11	0	2	35	48
Colorado-Utah	11	5	0	6	66,451	183	88	1	0	0	4	5	10	0	5	61	76
New Mexico	23	13	3	7	141,946	344	237	2	0	0	5	7	14	0	1	35	50
California	52	35	0	17	244,780	920	715	2	0	0	16	18	38	0	1	172	211
North Dakota	0	0	0	0	0	11	2	0	0	0	0	0	2	0	0	4	6
Miscellaneous (Mo., Md.)	2	0	1	1	4,869	25	14	0	0	1	0	1	0	0	7	10	17
Total United States	838	446	62	330	3,410,655	16,294	13,886	29	1	3	136	169	514	36	93	2,830	3,473
Total previous week	906	482	75	349	3,758,000			32	0	9	167	208	485	35	90	2,694	3,304
Total May 12, 1951	810	442	48	320	3,189,124			25	1	9	160	195	479	27	93	2,500	3,099

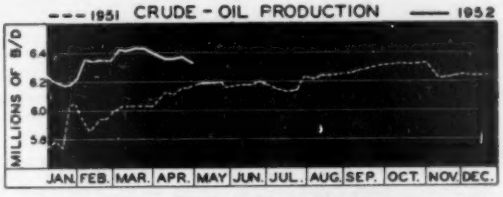
Service wells included: *9, †13, ‡2, §1.

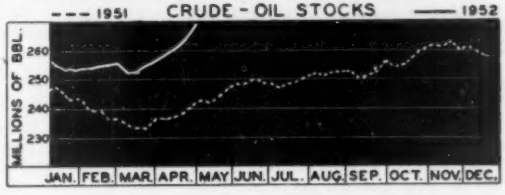






Owing to conditions brought about by the present labor strike affecting part of the oil industry, The Oil and Gas Journal is unable to make available the weekly estimate of crude-oil production in the United States for the week ended May 10, 1952.



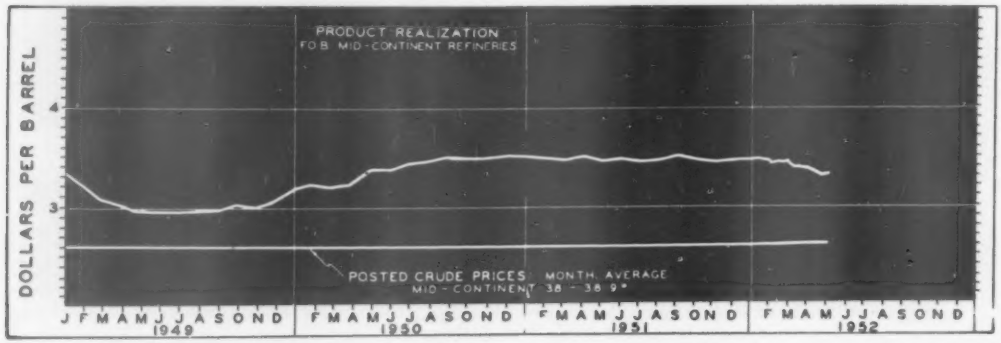


CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	May 3, '52	Apr. 26, '52	May 5, '51
Pennsylvania Grade	2,442	2,371	2,054
Other Appalachian	2,140	2,065	1,561
Illinois, Indiana, Michigan	12,316	11,499	10,473
Arkansas	3,065	3,002	2,520
Louisiana	14,616	14,449	13,900
North	2,890	2,756	2,692
Gulf	11,726	11,693	11,208
Mississippi	3,695	3,526	3,117
New Mexico	7,490	7,228	6,908
Oklahoma and Kansas	42,867	43,072	37,940
Texas	128,023	125,072	111,874
East Texas proper	12,177	11,605	(†)
West Texas	56,724	55,870	(†)
Texas Gulf	27,796	26,766	(†)
Other Texas	31,326	30,831	(†)
Rocky Mountain	15,024	15,077	14,209
California	30,473	30,157	30,306
Foreign	7,464	7,263	7,366
Total	269,615	264,781	242,228

*Bureau of Mines. †Not comparable with current week.


PRODUCT REALIZATION
F.O.B. MID-CONTINENT REFINERIES
DOLLARS PER BARREL
4
3
POSTED CRUDE PRICES: MONTH AVERAGE
MID-CONTINENT 38 - 38.9°
J F M A M J J A S O N D
1949
F M A M J J A S O N D
1950
F M A M J J A S O N D
1951
F M A M J J A S O N D
1952

In this trend chart refinery realization is based on average Mid-Continent grade crude oil (not 38° gravity only) and average prices for refinery products as published in The Oil and Gas Journal basis Oklahoma (Group 3). Refinery yields for current week are estimated. Realization averaged $3.31 for week ended May 3, $3.29 for previous week, and $3.47 for May 1951. The above trend information is based on volumes and current prices and therefore does not reflect changes in operating costs.

REPRESENTATIVE QUOTATIONS

Representative spot-market quotations of leading suppliers as of May 14, 1952. Figures are f.o.b. plant for tank-car shipments in cents per gallon, except for residual fuel oil which shows the price per barrel and wax, in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor (barge)	Texas Gulf Coast
Regular gasoline, 80-82 octane	10⅜-10½	12-12.75	10¾-11
Premium gasoline, 86-88 octane	11⅜-11½	13.5-13.75	11¾-12
42-44 w.w. kerosine	8¾-9	10-10.1	9
No. 2 straw fuel oil	7¾-8	9-9.25	8
No. 6 residual	$1.30-1.40	$2.45-2.60	$1.75-1.90

NATURAL GASOLINE

	Group 3	North Texas	N. La.
Grade 26-70	5½	5	5¼
Grade 18-55	6.6	6.1	6.35

LUBRICATING OILS

South Texas

200 vis., No. 2-3 neutral	13-13.5
750 vis., No. 3-4 neutral	16
2,000 No. 5-6 neutral	18-19

Mid-Continent

150-160 vis., D bright stock, 0-10 pp.	29
200 vis., No. 3 neutral, 0-10 pp.	16.5

Western Pennsylvania

145-155 vis., 10 p.t. bright stock	32.5
180 vis., 0 p.t. neutral	31.5

WAX

Mid-Continent

132-134 A.M.P.	5.5

GASOLINE is the only major product for which decided changes in market conditions have been brought about by the refinery strikes.

In the Mid-Continent and North Central areas gasoline prices are back up to ceilings in contrast with reported spot sales last month at prices at least 0.5 cent under ceilings. Almost all of the major suppliers are looking for gasoline, either for delivery at pipe-line terminals or by tank car. The search for motor gasoline has extended to some of the inland refineries in Texas whose normal markets are in the areas surrounding the plants. Some of these refiners are asking Group 3 prices at the plants plus an extra charge if the product moves in shipper's cars. If the normal freight differential for northern movement is added, the delivered cost at North Central markets would be higher than ceiling prices for the areas.

Tank-wagon prices are up 0.3 to 0.7 cent a gallon at points in the North Central area where prices have been subnormal during the winter.

Suppliers on the East Coast are reported to be holding most of their gasoline for regular customers with little or none offered on the open market. Only about 12 per cent of refining capacity on the East Coast is idle because of strikes, but movement of gasoline to this district from refineries on the Texas Gulf Coast has been cut by refinery strikes in that area.

Increases in Group 3 residual prices at the beginning of the strike period have not been followed by the expected strong markets for this product. Very little extra heavy fuel is reported moving from plants that are still operating in the district. If the strikes continue, consumer stocks of heavy fuel will be used up and refinery sales at operating plants will increase, but at the present, gasoline is getting all of the attention.

Shipments of kerosine and distillate fuel are reported to be light.

CRUDE PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.‡	Oklahoma, Kansas	Gulf Coast Tex.*	West Tex.†
18-18.9	$1.93			
19-19.9	1.98			
20-20.9	2.03	$2.25		$2.12
21-21.9	2.07	2.27		2.14
22-22.9	2.12	2.29		2.16
23-23.9	2.18	2.31		2.18
24-24.9	2.24	2.33	$2.56	2.20
25-25.9	2.30	2.35	2.58	2.22
26-26.9	2.36	2.37	2.60	2.24
27-27.9	2.41	2.39	2.62	2.26
28-28.9	2.46	2.41	2.64	2.28
29-29.9	2.52	2.43	2.66	2.30
30-30.9	2.57	2.45	2.68	2.32
31-31.9	2.62	2.47	2.70	2.34
32-32.9	2.68	2.49	2.72	2.36
33-33.9		2.51	2.74	2.38
34-34.9		2.53	2.76	2.40
35-35.9		2.55	2.78	2.42
36-36.9		2.57	2.80	2.44
37-37.9		2.59	2.82	2.46
38-38.9		2.61	2.84	2.48
39-39.9		2.63	2.86	2.50
40 and above		2.65	2.88	2.52

*For crude from Daboval, El Campo, and Sand Point.

†Includes Lea County, New Mexico. Last general price change represented a 50-cent increase becoming effective December 6, 1947.

‡Standard Oil Co. of California.

FLAT CRUDE PRICES

Representative posted schedules per barrel.	
Kettleman Hills, California*	$2.80
Louisiana:	
Beauregard Parish	2.60
Cotton Valley (distillate)	2.85
Cotton Valley (crude)	2.70
Texas:	
East Texas	2.65
Pecos County (Yates)	2.35
Conroe	2.83
Van	2.48
Pennsylvania Grade:	
Bradford	4.25
Southwest Pennsylvania	3.82
West Virginia	3.76
Illinois Basin	2.77

*37°-37.9°.

Boost for Storage

(*Continued from page 97*)

not be located so as to create transportation problems outweighing its natural advantage.

6. Since it appears desirable that every underground reservoir shall have a domed or vaulted roof with relative steep inclination, it may prove unsafe to allow the horizontal dimensions of such reservoirs greatly to exceed their height.

Therefore, in the construction of reservoirs in bedded salt deposits of limited thickness, relatively small individual reservoirs only will be practical. The economic advantage of such construction will finally disappear with depth of overburden, making such attempts inadvisable unless economy of steel or manpower, as such, should dictate the attempt.

Safety factors . . . Underground storage will offer the same problems of explosion and leakage as do conventional tanks, but the latter particularly will be the most serious hazard, particularly in the case of reservoirs in close proximity to settled communities. The considerations related to public safety were outlined in the report, as follows:

1. Reservoirs should be entirely enclosed in rocks that are effectively and permanently impervious by nature (or made so by artificial means) except where the contents will be positively confined by ground water.

Prominent among the impermeable rocks are salt, gypsum, igneous rock, dense limestone, and shale, providing in all cases they are not cut by fractures.

2. To guard against possible fracture of the reservoir by internal pressures it should be under cover of more than 1 ft. of depth for each pound of total (hydrostatic plus vapor plus pump) maximum pressure that may at any time exist within it, having due regard to the underground temperature in the locality and the depth considered. The additional thickness of cover that should be provided as a factor of safety must be determined for each individual case.

3. Competent engineering supervision should make certain that the roof of each reservoir is in rocks of sufficient strength and is designed in such manner as to preclude dangerous caving or upward fissuring.

4. All connections between the reservoir and the surface should be so sealed as to preclude possibility of fluid leakage, either upward or downward at any level. This condition should be demonstrated by adequate pressure tests before any oil is introduced into the reservoir.

5. Reservoirs preferably should be located outside the limits of municipalities.

6. Each reservoir should be separated from any other reservoir or underground excavation (actual or potential) by sufficient distance to preclude possible intercommunication.

7. Extreme care should be exercised in the construction of reservoirs to avoid rocks that could provide avenues of escape for the contained petroleum.

Tax Aid Granted

Texas Eastern project is largest approved by DPA

WASHINGTON.—Accelerated amortization on 25 per cent of a $98,900,843 natural-gas pipe line has been granted Texas Eastern Transmission Corp., Shreveport, by the Defense Production Administration.

The project was the largest of 205 defense-facility expansions approved by DPA during the week ended April 24.

Second largest project approved for the oil industry was $15,000,000 for water transportation on which quick write-off was approved for Sun Oil Co., Marcus Hook, Pa., on 60 per cent of the investment.

Refining . . . A number of refining projects were granted accelerated amortization, as follows:

Old Dutch Refining Co., Muskegon, Mich., gasoline and fuel oil, 65 per cent of $2,730,000, 50 per cent of $165,000, and 35 per cent of $465,569; Keystone Oil Refining Co., Detroit, products, 65 per cent of $525,000; Western Reserve Refining Co., Niles, Ohio, gasoline, 65 per cent of $95,000, and 40 per cent of $150,000; Gilcrease Oil Co., Meraux, La., gasoline, 65 per cent of $1,055,000 and 40 per cent of $525,000.

Phillips Oil Co., Phillips, Tex., motor fuel, 90 per cent of $152,500, 65 per cent of $23,500, and 25 per cent of $180,000; Inland Refining Co., Tucker, Tex., gasoline, 65 per cent of $243,000; Pure Oil Co., Andrews County, Texas, natural gasoline, 65 per cent of $882,700.

Shell Oil Co., Deer Park, Tex., products, 50 per cent of $1,300,000; and facilities for crude oil, 40 per cent of $1,075,000 and 15 per cent of $25,000; Petrolite Corp., Ltd., Port Arthur, Tex., crude refining, 65 per cent of $63,678; Atlantic Refining Co., Atreco, Tex., gasoline, 65 per cent of $1,011,900 and 40 per cent of $121,500; The California Co., Rangely, Colo., butane and natural gasoline, 65 per cent of $671,152.

Transport . . . Transportation projects were approved for Inland Corp.'s pipeline system in Ohio, 25 per cent of $244,158, 15 per cent of $241,885, and 10 per cent of $171,295; Union Tank Car Co., Chicago, transportation of liquefied petroleum gas, 70 per cent of $5,700,000; Cities - Blackwell Corp., Bartlesville, Okla., transportation of liquefied petroleum gas, 70 per cent of $1,649,900.

Amortization of 40 per cent of the investment was granted Socony-Vacuum Oil Co. at Irwin, Pa., $85,020; Sid Richardson Gasoline Co. at Kermit, Tex., $35,458; Oil Terminals Co. at Colusa, Calif.; $247,490, and Shell Oil Co. at Portland, $225,000.

No Refinery Report

Since the refinery strike has made it impossible to obtain accurate and complete information on refinery operations, the American Petroleum Institute did not issue a refinery report for week ended May 10.

Piping Needs Can Be Met

WASHINGTON.—The metal-piping industry has adequate production capacity to meet the requirements of the refinery-expansion program of the Petroleum Administration for Defense as well as other mobilization demands, but there are serious problems of controlled materials.

The industry's situation was outlined to National Production Authority officials last week at a meeting of the industry-advisory committee at which the Government was urged to relax inventory controls because of the highly specialized nature of industry supplies and other factors. NPA officials, however, held out little promise of action, pointing out that exemption of an entire industry from inventory controls was contrary to policy.

The industry can absorb the production necessary to meet expanded programs of PAD and other agencies, provided that labor is available consistently and materials may be obtained from suppliers, NPA was told. However, it was admitted, the accelerated PAD program calling for an 11 per cent increase of refinery installations in 1953, plus the big program of power expansion, will have an impact on the industry next year.

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EQUIPMENT MEN . . . in the News

Emrick to Represent W-K-M In Rocky Mountain District

W-K-M Co., manufacturer of christmas-tree, pipe-line, and refinery valves, has announced the appointment of James E. Emrick as its representative in the Rocky Mountain district. Emrick's headquarters, James E. Emrick Co., is located at Casper, Wyo.

Krueger Is Promoted to General Sales Manager

W. F. KRUEGER

William F. Krueger, who for the past 5 years has been in charge of sales in the Houston district for Sperry-Sun Well Surveying Co., has been promoted to general sales manager of the company, with headquarters at Houston.

Following his graduation in petroleum engineering from University of Oklahoma, Krueger was with the U. S. Bureau of Mines for 3 years before joining Sperry-Sun in 1938 as sales and service engineer.

Quentin B. Marsh, who joined Sperry-Sun in Illinois in 1948, has been promoted to managership of Sperry-Sun's Houston district sales department, replacing Krueger.

Refinery Supply Promotes Okeson and Williams

J. B. OKESON

T. C. WILLIAMS

W. A. Schlueter, president of The Refinery Supply Co., has announced the appointment of J. B. Okeson as vice president in charge of sales, and T. C. Williams, vice president in charge of operations. Both of these men have been with the company for over 25 years.

New Posts Announced For Three Otis Pressure Men

T. G. GARWOOD

Turner G. Garwood has been appointed sales manager for Otis Pressure Control with headquarters at Dallas, it has been announced by H. C. Otis, Jr., executive vice president of the firm. The company has also announced the promotion of Donald F. Taylor as manager of its special service department. K. W. Robbins, formerly chief corrosion-analysis engineer in the calipering department of Otis Pressure's Houston office, has been transferred to Dallas as an engineering consultant.

Garwood's previous assignment was in the company's Houston office as senior engineering consultant for the Gulf Coast area. He has been with Otis for more than 15 years, having worked out of Oklahoma City, Houston, and New Iberia, La., Otis offices. Garwood replaces Lowell M. Wilhoit, who has been appointed production manager of Otis Engineering Corp., affiliate of the pressure-control company.

D. F. TAYLOR

K. W. ROBBINS

Formerly an engineering consultant for Otis, Taylor's new duties will place him in charge of engineering and installation of Otis two-zone pumps and packers and other special Otis equipment. Taylor has been with Otis for several years, holding various engineering positions.

Robbins began with Otis 6 years ago as a field engineer for wire-line operations and high-pressure tubing and drill-pipe jobs. In his new position he will travel the northern and western parts of the Mid-Continent area working out of the home office in connection with engineering and installation of Otis tools, equipment, and services.

Superior Iron Works Opens New Store, Warehouse

An open house for about 1,000 men in the oil industry was the occasion for the formal opening of Superior Iron Works & Supply Co.'s new district office, store, and warehouse at Midland, Tex.

The new store is Superior's second in West Texas, the first being opened in Abilene, Tex., about a year ago. Material for all phases of oil-field operation, including drilling, production, pipe line, and refinery and gasoline-plant equipment will be stocked at this new location.

The new district will be managed by T. C. (Tom) Hemdricks. H. A. Alexander is store manager. Darwin Hallum is special representative for refinery and gasoline-plant sales; Al Hart, Jack Parsons, and Dave Witherspoon, field representatives; Bill Sargeant, K. E. Blanchard, and Roy Hicks, office and store men.

Officers of the company who visited the opening were T. J. Summers, vice president and general manager; C. B. Watson, vice president; B. V. Brown, purchasing agent; John Morgan, special representative, and F. H. Gibson, Dallas division manager for North and West Texas.

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FOR SALE: Wilson Giant Draw Works: 2—Buda JL-1335 Motors with chain compound: 2—Code Butane Tanks: 4 Sheave National Traveling Block: 1—HP-217 Buda Engine: 5000' 4½" Drill Pipe. All in good drilling condition. Powell Drilling Company, 306 Derby Bldg., Wichita, Kansas.

LIKE NEW D-13000 Caterpillar. Twin Disc Clutch and Sheave. 5951 actual hours. Price $3500. C. Spitzfaden, Box 2001, Wichita, Kansas, LD 128.

FOR SALE: Two 28-L Bucyrus Spudders, tools 15½" down to 2½" with complete combination rotary to run off of either rig. One tandem truck, one light truck. 10¾ and 8⅝" casing. Further details, write or call L. & L. Drilling Company, Phone 69, Box 67, Cross Plains, Texas.

FOR SALE

7—CLARK GAS ENGINE GAS COMPRESSORS

1—230 H.P.—17x18x26x20
1—230 H.P.—17x18x24x20
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Immediately Available

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All used, good condition, seam to seam, welded code construction. Built by A. O. Smith Corp. Located near Chicago, Ill. Prints, prices available on request.

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EQUIPMENT FOR SALE

7500' OF API Full Hole 4½" Drill Pipe. Graded and tested by Sonoscope engineers. Milford Giffin, Giffin Hotel, Tel. 477, Hoisington, Kansas.

FOR SALE: 10¾", 32#, 8⅝" 24#, and 7" 25# good casing located in Central Pennsylvania. Write Box E-775, The Oil and Gas Journal, Tulsa, Oklahoma.

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2000' 2" EUE Tubing, 500' 4" casing, 1200' ⅝ rods, Jenson Pumping unit with motor, misc. valves, fittings, etc. for shallow well. Stored in Ft. Bend County, Texas. Write Box E-778, The Oil and Gas Journal, Tulsa, Oklahoma.

Gaso Duplex 4½" x 6" Power Pumps with Chrysler C-36 Engines, skid mounted, immediate delivery. Also Byron Jackson, Carter Centrifugal Units. Westinghouse 20-25-50 KW Generating Units.

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Designed and fabricated by Braun to stabilize 6,000 bbls./day 67° API gravity crude.

Design: API-ASME code 200 psi W.P., 400° F., 375 psi Test
Dimensions: 66" x 59', .750" Shell, .750" Semi-Ellip. Heads, 30 trays on 18" spacing, Weight 47,500#
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Braun, horizontal, removable tube bundle, seamless admiralty tubes, cast-semi-steel body.
4—18" ID x 12', 4 pass tubes 250 psi, 2 pass body 200 psi
2—15" ID x 12', 2 pass tubes 100 psi, 2 pass body 200 psi
2—22" ID x 15', 6 pass tubes 100 psi, 2 pass body 200 psi

Reboiler

Braun, kettle type, removable tube bundle, seamless admiralty tubes, steel body, 26" x 48" x 21', 2 pass tubes 300 psi, body 200 psi at 400° F.

Steam Pumps

1—National Transite, Duplex, 8 x 4 x 12
3—National Transite, Duplex, 7½ x 5 x 10
2—Burnham, Simplex, 8 x 7 x 20

Reflux Accumulator 66" x 12'
Piping, Valves and Fittings
Brown Instrument Controls
Located in Wyoming

Drawings and Specifications Available

For further information please contact:

The Ohio Oil Company
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Franks SAL-5000 rig. 2 NHS Cummins diesel engines. Franks rotary rig 96 feet. Jackknife derrick. Provided with pump drive. Good condition. Ready for immediate delivery. Box E-726, The Oil and Gas Journal, Tulsa, Oklahoma.

TWO pipe pulling machines, heavy duty double drum draw works. International Motors, spudding attachments to rig casing pipe break-out and cathead, 55' steel A-masts. Tools, 15 down spiders, tongs, elevators, stems, rippers, bailers. Phones 2-0061, 7-5013, 1323 East 26th Place, Tulsa, Okla.

FOR SALE: 3000' of 3½" modified drill pipe, Wichtex Draw Works, 65' mast, 17" Oil Well Rotary table, C-100 Ideal 6¼" X 10" mud pump with motor, PA-100 International Draw Works motor, GMC truck 2½ ton tandem, Ford truck 1½ ton, oil field beds and winches. Have all necessary equip. for complete rig. Trade for production. Cash Price $27,500.00. Box 583, Ardmore, Oklahoma. Phone 4726.

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No Priority Required

4 x 6—4,000# Plunger Load.
4½ x 6—6,000# Plunger Load.
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WELL SERVICING UNITS — Skid type, Single Drum Cardwells, Wilsons, Allis-Chalmers, Muskogee, Keltner. Double & Single Pole Mast. Have Draw Works on long skids w/ 86' Double Pole Rotary Mast for shallow well rotary. For sizes & prices—Write General Tool & Supply Co., P. O. Box 4367, Oklahoma City.

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USED well drilling equipment. We buy and sell spudders, rotaries, core drills, tools, pipe, blocks, pump jacks, everything for well drilling and service. All used equipment fully reconditioned. Contact us for your requirements and save money. We rent fishing tools. Pressey & Son, Pueblo, Colo.

FOR SALE: One Ready-Power Engine Generator, complete with control cabinet with automatic or manual regulator switch. Specifications are KVA 28.75, KW 23, Volt 120-208, Amp. 64, Phase 3, Wire 4, RPM 1200, Cycle 60, will run on either gasoline or on natural gas, 60 Horse Power International U-9 Engine. This has been used as a standby source of electric power but it is in good condition. It may be inspected at our plant located eight miles South of Ulysses, Kansas, on Highway 270. Price, $1,500. Address inquiries to Hugoton Production Company, Garden City, Kansas.

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11—55,000 bbl. Tanks—114' 6" dia. x 30' high
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All tanks steel roof, riveted construction throughout. Standing location near Mexia, Texas, and suitable for re-erection. Detailed specs. and prices available on request.

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1 Gyro Compass, Sperry Mk. 14 Mod. 1.
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1 Galley Range, Shipmate Oil Burning with double ovens.
1 Refrigeration Plant, 3 door walk in storage chests with refrigeration plant.

This vessel was in first-class operating condition up to the time it was decommissioned by the U. S. Navy. All Radar, Degaussing and other Navy equipment was removed. Engine room equipment is complete and in good condition, but would need overhauling. Cleaning and coat of paint would restore hull, decks and cabins to excellent condition.
Original cost of yacht—approximately $300,000.00. Will sell for $45,000.00, as is, Boston Navy Yard.
Complete specifications and blue prints available on request. Inspection arranged at any time.

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FOR SALE: One Model 36-L, Bucyrus-Erie, Type EB Spudder. Equipped with Buda L.O. 525 gas-gasoline engine, casing tackle strut, tool crane, cables, light plant, water tank, and complete tools for 12", 10", 8", and 6" hole. Price F.O.B. Princeton, Indiana and subject to prior sale $18,000.00. Randall-Zogg Supply Company, P.O. Box 3, Princeton, Indiana. Phone 802 or 219.

FOR SALE: One completely rebuilt, model 24-L Type EB, Bucyrus-Erie Spudder. Equipped with Buda H.P. 326 engine, 40' telescopic derrick, power derrick hoist, swabbing unit, catheads, and casing reel. Price F.O.B. Princeton, Indiana, and subject to prior sales $6,500.00. Randall-Zogg Supply Company, P.O. Box 3, Princeton, Indiana. Phones 802 or 219.

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FOR SALE: Mayhew 2000 Core Drill with 145 HP Ford auxiliary motor, mounted on 6 x 6 G.M.C. truck, practically new, A1 condition. Lewis and Clemens Drilling Co., Princeton, Ind. Phone 706.

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FOR SALE: Good 3½" and 4½" OD Drill pipe. Two EKU Waukesha's, One RL Cardwell, Hercules Engine, Tanks, Treaters, Pumping units. Rogers Pipe & Supply Co., 620 Wright Bldg., Tulsa, Oklahoma.

NEED a good 4500 foot draw works? Wilson Giant, Vacuum controlled, GM 12103 Twin Six Diesel, Pump drive, Friction catheads. Excellent running condition. Located Great Bend, Kansas. C. Spitzfaden, Box 2001, Wichita, Kansas. L. D. 128.

ONE Cooper-Bessemer Type FWDR-8T Marine Type 8 cylinder (600 HP at 750 RPM) turbocharged full diesel engine with full complement of auxiliaries including: reversing mechanism, fuel oil filters, lub oil filter cooler and pump, gages, thermometers, governor, alarm signals, Maxim silencer, and air starting system. Can be converted to gas. This engine was purchased new and placed in operation in June 1948 and has operated approximately 7,400 hours. It has had top quality maintenance, is in good condition, and is available because the drive it served has been electrified. PRICE: $9,500.00 F.O.B. Prospect Hill, Mo. As is—Subject to Prior Sale. Address replies to: Missouri Portland Cement Co., 3615 Olive Street, St. Louis, Missouri.

WILSON Giant draw works powered with 2 model 12103-HD GMC Twin Diesel Engines. Can be inspected while running. Phone 3-2806, Wichita, Kansas, or P. O. Box 497, Tulsa, Oklahoma.

WE sell used/rebuilt Well Drilling Equipment, Bulldozers, Draglines, electric generating plants, air compressors, trenchers, railroad equipment, surplus machinery, etc. Mr. Gonzales, Baker Export Co., Pecos, Texas.

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EQUIPMENT FOR SALE

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FOR SALE: International LF212 RD450 Tandem winched rollered flat bed truck with tandem pole trailer; TD18 International Cat with winch and blade. Box 176, Salem, Illinois.

EQUIPMENT WANTED

WANTED: Jackknife Derrick and Substructure. Prefer L. C. Moore 87′ or 94′. Will consider any good Jackknife. Contact Box 1022, Del Rio, Texas.

WILL PAY highest prices for used casing, used line pipe, abandoned leases, or other surplus lease equipment. Your idle producing equipment is worth dollars. Green Pipe & Supply Co., Box 1383, Tulsa, Oklahoma.

1,400 FEET or less 3½" EUE or 2⅞" EUE drill pipe, new or good used. One 30 foot 4¾" drill collar, new or good used. Have PAD authorization for pipe. Box E-606, The Oil and Gas Journal, Tulsa, Oklahoma.

WE BUY well drilling equipment machines, cable tools, pipe, etc. Turn your surplus equipment into cash. Pressey & Son, Pueblo, Colorado.

USED: 1—13⅜" BJ Spider. 1—13⅜" BJ Elevator. 1—10¾" BJ Elevator, with or without slips. Box 251, Dove Creek, Colorado.

WILL TRADE—600 joints of second-hand lapweld tubing at Garnett, Kansas, for 4½" line pipe. Contact Huitt, Deep Rock Oil Corp., Tulsa, Oklahoma.

WILL TRADE—6500′ of 9⅝" 43.5# N-80 casing at Odessa, Texas, for 5½" casing. Contact Huitt, Deep Rock Oil Corp., Tulsa, Oklahoma.

LOSS CORPORATION

Want drilling or oil producting corporation showing operating loss over $25,000; will pay cash. Airmail or wire details to

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WANTED — EQUIPMENT TESTING ENGINEER

Phillips Petroleum Co. needs a graduate mechanical or chemical engineer with 3 to 5 years experience in design, testing, or operation of mechanical equipment used in the LPG industry. Write, giving qualifications, to Employe Relations Department

Phillips Petroleum Company
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SENIOR PETROLEUM ENGINEER

Major oil company has opening for senior petroleum engineer in Middle East producing operations. Degree in Petroleum Engineering and not less than eight years experience including some experience with Sand Reservoirs essential. Write giving full details of experience and salary expected.

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CONTROLLER-TREASURER . . . Minimum 10 years' experience in oil or process industry including office supervision, budgets, procedures, cost control, taxes. College graduate. Age 35-45. Salary $11,000-$12,000. Location: Midwest. Please send detailed resume. Box E-762, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED — SEISMOGRAPH PARTY CHIEF. Must be fully qualified. Age 27-38. A good opportunity for the right man. Box E-770, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED

Manufacturer Sales Agent. Plastic pipe manufacturer. Pipe used in oil and agricultural industries. Set-up distributors; liberal commission. Contact

Box E-764
THE OIL AND GAS JOURNAL
Tulsa, Oklahoma

RESERVIOR ENGINEERS

Major Oil Company has openings in Venezuela for qualified Reservoir Engineers. Age 26-40, B.S. in Petroleum Engineering or equivalent. 5-7 years' exp.

Write giving full details to:

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Bowling Green Sta., N. Y. 4, N. Y.

HELP WANTED

RESERVOIR ENGINEER with over 5 years' experience, including field training. Independent California operator. Box E-748, The Oil and Gas Journal, Tulsa, Oklahoma.

KEY Seismograph Personnel Needed by Established and Expanding Seismograph Company. Box E-616, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Combination Safety Engineer and Metal Inspector. Southwest Refinery. Box E-681, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED Seismograph party chief. Interested in profit sharing with small organization. Box E-751, The Oil and Gas Journal, Tulsa, Oklahoma.

SMALL progressive engineering company requires petroleum engineer qualified for registration to supervise core analysis laboratory and engage in reservoir engineering. Permanent and good future for right man. Box E-739, The Oil and Gas Journal, Tulsa, Oklahoma.

PURCHASING AGENT

Major petroleum refinery and chemical plant construction company located in New York has excellent opportunity for outstanding Purchasing Agent with minimum 10 years' experience in refinery type of job purchasing. Please submit complete resume including past earnings record. Your reply is confidential.

Box E-776, The Oil and Gas Journal
Tulsa, Oklahoma

MUD TECHNICIANS

Major oil company in Venezuela has openings for experienced mud technicians. Age 25-40; 2 years college and specialized training. 1-3 years' experience. Approximate annual earnings $8330.

Write giving full details to:

GULF OIL CORP.
Foreign Prod. Div.
P.O. Box No. 35, New York 4, N. Y.

CHEMICAL ENGINEER

Petro-Chemical Plant desires young Chemical Engineer interested in development program of water treatment and industrial waste disposal including boiler plant, cooling water, biological digestion pilot plants for effluent. Salary commensurate with background. Send outline of training, education, and personal data to Personnel Superintendent

Celanese Corporation of America
Box 148, Bishop, Texas

OPPORTUNITIES FOR TECHNICAL REFINERY PERSONNEL for LARGE INTERNATIONAL OIL COMPANY

Entertaining applications of graduate chemical, mechanical, structural and electrical engineers for refinery engineering assignments at home and abroad.
Engineers with refinery experience and also recent graduates will be considered.

Box E-667, The Oil and Gas Journal, Tulsa, Oklahoma

HELP WANTED

PETROLEUM GEOLOGIST with background of practical experience in land leasing and royalties. Qualified to determine and appraise the merits of a deal. Splendid opportunity to start and grow with new venture in Rocky Mountain Oil development. Prefer married man who would live and make headquarters in Denver, Colorado. Mostly office work, some traveling required. Write giving qualifications and experience. Box E-769, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICIST: Moderately sized company with active exploration program desires geophysicist. This company presently conducting geophysical program with contract geophysicist but is planning on Geophysical Department. Only applicants under 35 years and with sufficient training and experience to act as supervisors considered. Prefer men with major company experience. Permanent location at company headquarters. Write giving experience and training in detail, and salary desired. Box E-766, The Oil and Gas Journal, Tulsa, Oklahoma.

NOW READY: List showing where to apply for foreign oil jobs. Write for price. OIML Co., Box 2603, Tulsa, Okla.

INDEPENDENT, integrated oil company in California requires an experienced land man under 40. Salary open. Permanent and good future for right man. Box E-772, The Oil and Gas Journal, Tulsa, Oklahoma.

OIL Industry Employment Service, 405 Tuloma Building, Tulsa, Okla. 4-5974. Tom Robinson, owner. For Technically trained personnel. No fees. Confidential.

WANTED: Experienced Fluid Catalytic Cracking Operator to become supervisor of Cat Cracking and to assist superintendent. Location New Orleans. Technical man preferred. Give education, past employment and salary expected. Box E-754, The Oil and Gas Journal, Tulsa, Okla.

EXPERIENCED engineer capable of designing and servicing Wellhead equipment such as separators, treaters, heaters and attendant equipment handling crude oil to storage. Location Tulsa area with progressive steel plate fabricator. Box E-752, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEERS, Executives, Technical Men. Salaried positions—$3600 to $30,000. This confidential service for outstanding men who desire a change of connection. Will develop and conduct preliminary negotiations without risk to present position. Send name and address for details. Tennant Associates, 334 Frick Bldg., Pittsburgh 19, Pa.

SITUATIONS WANTED

EXPERIENCED oil field mechanic, gas, butane and Diesel engines, good references. Box E-734, The Oil and Gas Journal, Tulsa, Oklahoma.

ATTENTION: Well established oil well drilling contractor desires to manage and supervise: Individuals', groups', small or medium-sized oil companies' drilling, production and operating problems in Central and Western Texas, and New Mexico. Personal interview by appointment is desired. Makin Drilling Company, Box No. 1628. Ph. No. 131, Hobbs, New Mexico.

ATTENTION: I would like to contact Independents, Individuals and Small Groups in the Tri-State area of the Illinois Basin who desire supervision and management of their Drilling, Completion and Production problems on a contract basis. Thoroughly experienced in this area. Recommendations furnished on request. Box E-738, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM Production Engineer with 15 yrs. experience in drilling, completion, work-over, production work and supervision of production and engineering departments. Presently employed, desires change to a progressive company with future. Reply Box E-756, The Oil and Gas Journal, Tulsa, Okla.

PETROLEUM ENGINEER: 8 years varied drilling, completion, production, and work-over experience, desires responsible production or engineering position. Box E-758, The Oil and Gas Journal, Tulsa, Oklahoma.

SUBSURFACE GEOLOGIST—8 years major company exploration experience. Desires change. Excellent references. Box E-773, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

SUPERINTENDENT desires connection with progressive independent. Experienced in Oil and Gas production and drilling. Petroleum Engineering degree. Box E-740, The Oil and Gas Journal, Tulsa, Oklahoma.

SUPERINTENDENT, general field operations available at once. Age 48, experience 20 years. Morals and ability unquestionable. Recently resigned former position. References. P. O. Box 1089, Houston 1, Texas.

SEISMIC INTERPRETER desires long term contract in consulting capacity with major oil company or large firm. Eight years varied experience in supervision and interpretation of seismic work, mostly in Mid-Continent region. Prefer to choose own location for working base. Information and Techniques from past and future employment held strictly confidential. Will consider following: Final Prospect Evaluation; Seismic Reanalysis; Geophysical Adviser; Seismic Work Supervision. Box E-767, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED PETROLEUM GEOLOGIST, age 32, eight years major company experience including foreign. Well experienced all phases subsurface and well work. Presently employed. Seeks domestic or foreign position, either in geology or associated work, with major or independent. Box E-765, The Oil and Gas Journal, Tulsa, Oklahoma.

GRADUATE petroleum engineer, 29, married, three years intensive experience includes drilling, completing, producing, and reworking oil and gas distillate wells, and collecting and keeping engineering data and records, desires position with good possibilities for advancement. Independent or company. Box E-763, The Oil and Gas Journal, Tulsa, Okla.

GAS ENGINEER, Age 29, 4 years experience, gasoline plant construction, design, operation and laboratory; pod operator; corrosion engineer. Petroleum Refining Engineering Degree. Box E-777, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION SUPERINTENDENT. Graduate Petroleum Engineer. 12 years responsible experience producing industry. Geological ability. Mid-Continent or Rocky Mountains. Box E-774, The Oil and Gas Journal, Tulsa, Oklahoma.

BUSINESS OPPORTUNITIES

SULFUR RECOVERY—A client of our firm is interested in obtaining sulfur and willing to enter into a long term agreement with companies having waste hydrogen sulfide streams. He is ready to install at his expense sulfur units and wishes purchase H_2S. Willing to consider other arrangements. Minimum amount of sulfur approximately seven tons per day. Replies in strict confidence. R. S. Aries & Associates, Chemical Engineers and Economists, 400 Madison Ave. NYC.

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South American corporation with experienced American petroleum engineering personnel and Venezuelan warehouse facilities desires additional representations in drilling, producing, pipe line, gas plant and refinery equipment, materials and services for part or all of South America. Reply Box E-771, The Oil and Gas Journal, Tulsa, Okla.

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Send for list. Can offer Williston Basin minerals for $10 per acre with $1.00 annual rentals. Can sell in minimum tracts of 40 acres. Solicit sales only to those connected with oil or royalty business. References exchanged. Write or call Milburn & Milburn, Sewell Building, Telephone 6-6439, Odessa, Texas.

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Dealers in Montana royalties since 1921, we now specialize in royalties under major company leases in the Montana portion of the Williston Basin. For information on our method of operation, write LANDOWNERS ROYALTIES COMPANY, Box 1225, Great Falls, Montana.

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P. O. Box 881
Tulsa, Oklahoma

LEASE AND DRILLING BLOCKS

WILL pay cash instantly for leases (large blocks), royalties, mineral deeds, production. Write fully—P. O. Box 2153, Denver, Colorado.

WOULD SELL few 10-year leases to support wildcat in shallow part of Williston Basin. Expect production in Viola Limestone at 2900'. Good geology. 7000 acre enclosure. Township 28N, Range 9W, Holt County, Nebraska. Also possibility of buying royalty. Lloyd J. Twibell, Orchard, Nebraska.

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LEASES and MINERALS

Our latest lists with prices mailed on request. We solicit only those connected with the Oil Industry, or Royalty business. References exchanged.

JOHN ALLEN
200 Grand Pacific Hotel Phone 3850
Bismarck, North Dakota

TAX MONEY PARTNER WANTED

Famed Four Corners Area, New Mexico, Colorado, Utah and Arizona, seems destined shortly to become second oil and gas Williston Basin similar Dakotas and Montana. Large oil and gas fields already producing in New Mexico, Colorado and Utah and geologists insist Arizona production potentialities tremendous. I own approximately 120,000 acres State and Government Arizona oil and gas leases in good standing, on recognized structures, four to five years unexpired term, some being close to wells already being drilled, these leases costing me from 20c to $1.00 per acre. I want partner with $60,000.00 to take over undivided one-half interest this acreage, paying future rentals. Drilling money not necessary as we will be riding other fellows' drills down. Any losses sustained tax deductible. For details, **Box E-759, The Oil and Gas Journal, Tulsa, Oklahoma.**

LEASE AND DRILLING BLOCKS

FOR LEASE: 126,000 acres Central and Eastern Nebraska; 100,000 acres Central and Eastern Montana; 55,000 acres Idaho; 111,000 acres Eastern North Dakota; and 243,000 acres South Dakota. Reasonable terms. If interested, write J. C. Hatfield, Vice President, The Union Central Life Insurance Co., Box 177, Cincinnati 1, Ohio.

ENORMOUS flows of gas in Culberson County, Texas, indicate similar deposits of oil close-by, possibly the coming hot spot in the Nation. I can furnish 10-year leases on 1 to 50 sections at market prices which are sure to advance rapidly. E. L. Stratton, Pecos, Texas.

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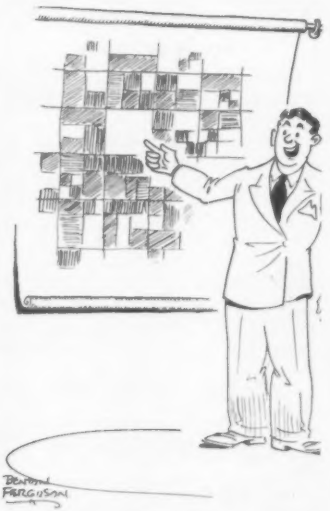
Box E-709, The Oil and Gas Journal, Tulsa, Oklahoma



"I've got the whole area leased, chief, except for this section on the top of the dome, but luckily, I found out it's owned by a distant relative of mine and..."

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Loadcraft Expands Operations to Rocky Mountain Area

Spencer-Safford Loadcraft, Inc., recently announced the opening of a factory branch in Denver. This new addition to Loadcraft's expanding operations will offer to trailer operators in the Rocky Mountain area a modern, well-staffed service shop, trailer parts, and trailer sales facilities. The new factory branch contains shop area, spare-parts stockroom, and sales offices.

This branch will be under the supervision of R. J. (Rudy) Partsch, Denver district manager, who is well known to the many operators of truck-trailers in this area. Assisting Partsch will be H. W. (Hank) Wisenborn, formerly Denver service manager of Trailmobile. W. E. (Bill) Sode, service shop manager, has had over 9 years of trailer factory shop experience and brings to the Denver branch a wealth of practical and technical knowledge.

Thermoid Co. Adds Three Assistant Vice Presidents

Three assistant vice presidents have been added to the roster of officers at Thermoid Co., according to Fred Schluter, president, Fred Matheis, Alvan Campbell, Jr., and Tharon J. Ellis were named at a recent Thermoid board of directors meeting to fill the new posts.

Matheis has been associated with Thermoid for over 35 years. A graduate chemist, he has worked in production of industrial rubber and insulated wire products; and is presently assistant sales manger of Thermoid's industrial rubber division.

Campbell joined Thermoid in 1938 and is the company's production planning manager as well as service manager of its special sales division. He is a graduate of Princeton University.

Ellis is factory superintendent of Thermoid's rubber division, and has been with the company 3 years. He previously held an executive manufacturing position with Firestone Rubber Co.

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In Perforating, Testing, and Fishing Tool Services

McCULLOUGH
NEW SERVICES • NEW TOOLS
NEW WAYS OF DOING THINGS

Latest News About New Tools, Techniques and Services

RESULTS and RECORDS

RESULTS SELECTED FROM RECENT McCULLOUGH FIELD REPORTS

DEPTH OF OPERATION	McCULLOUGH TOOL and RESULTS	McCULLOUGH BRANCH
1. 16,115 feet	New Radiation Well Logger—Gamma Ray and Neutron; Bridging Plug; and Glass Jet Perforator with Steel Strip Carrier. On test after obtaining world's deepest production.	Casper, Wyoming
2. 13,211 feet	Mechanical Long Knife Internal Cutter. Size: 2¼", run in on 1¼" tubing. Three cuts made, the lowest one at 13,211 feet.	Ventura, California
3. 13,005 feet	5" Jet Casing Cutter. 18# N-80 casing. Temperature over 277° F. 13,005 feet of casing recovered.	Casper, Wyoming
4. 12,500 feet	Bullet Type Gun Perforator (Burrless Bullets). One string of cemented casing—5½". 1560 B/D potential.	Hobbs, New Mexico
5. 12,492 feet	Radiation Well Logger and Bullet Type Gun Perforator (Burrless Bullets). One string of 6⅝" 32# casing. Engineers reported a very good well, production not released.	New Iberia, Louisiana
6. 12,265 feet	Glass Jet Perforator with Steel Strip Carrier. One string of 5½" cemented casing. 3100 B/D.	Odessa, Texas
7. 11,495 feet	Bottom Hole Jet Cutter. Temperature 280° F. Eliminated junk in bottom of the well.	Bakersfield, California
8. 10,200 feet	10¾" Jet Casing Cutter. 51# N-80 cemented casing. 10,200 feet of casing recovered.	Casper, Wyoming
9. 10,000 feet	Magna-Tector and String Shot Back-Off. Stuck drill pipe recovered without damage.	Ventura, California

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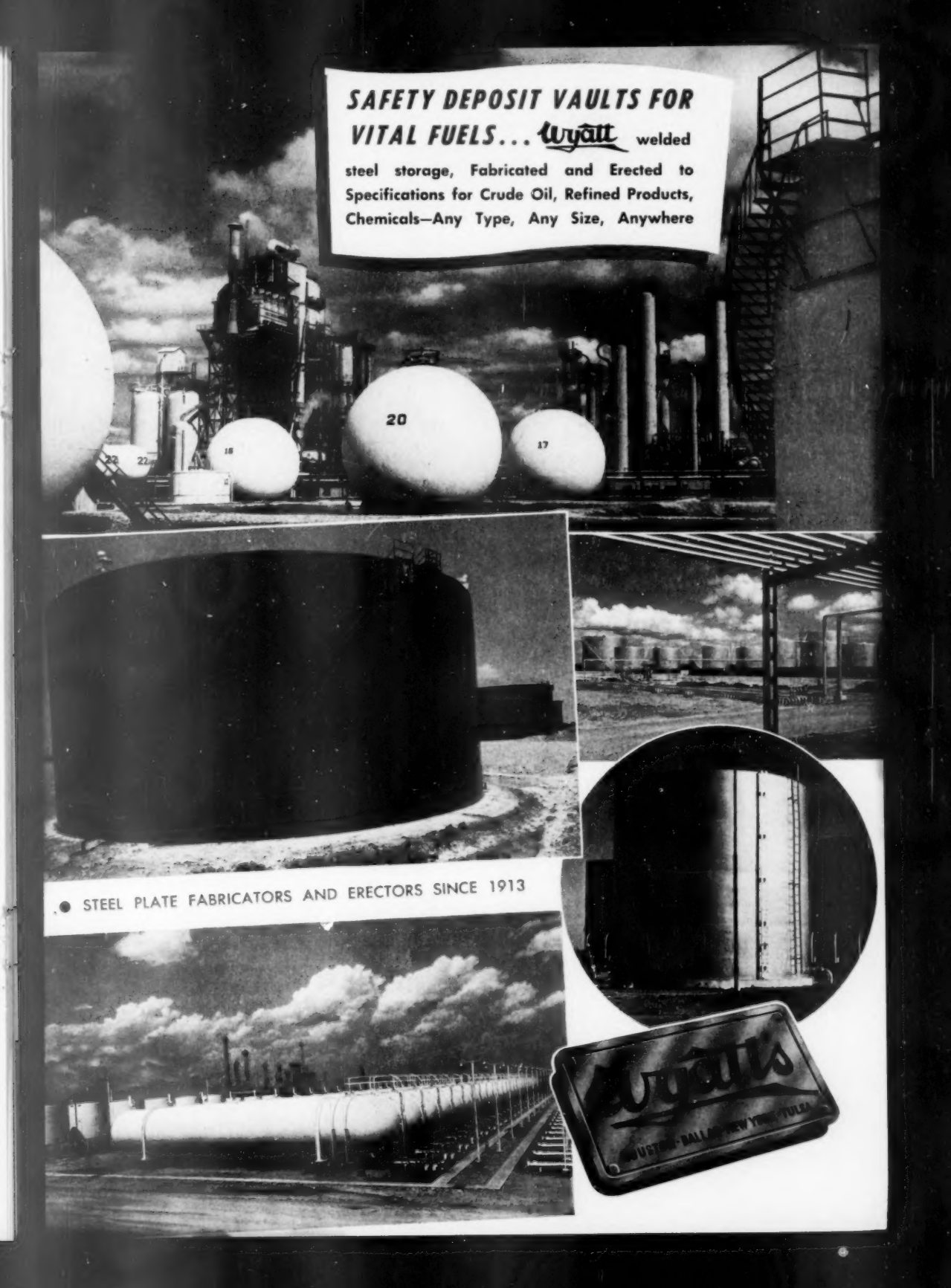
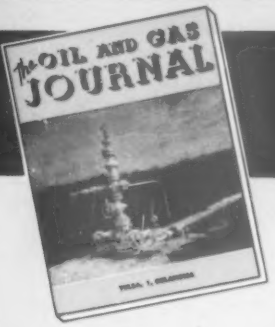
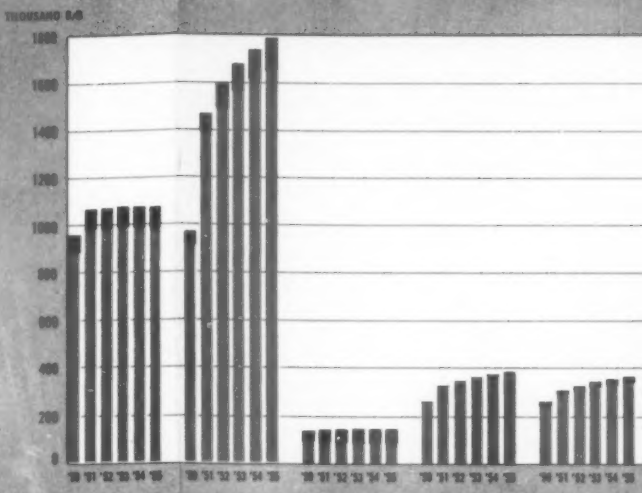
SERVICE LOCATIONS: **TEXAS:** Houston, Snyder, Alice, Cisco, Corpus Christi, McAllen, Odessa, Tyler, San Angelo, Victoria, Wichita Falls. **OKLAHOMA:** Oklahoma City, Guymon, Healdton. **MISSISSIPPI:** Laurel. **NEW MEXICO:** Hobbs. **KANSAS:** Great Bend. **WYOMING:** Casper. **CALIFORNIA:** Los Angeles, Avenal, Bakersfield, Ventura. **LOUISIANA:** Houma, Lake Charles, New Iberia, Shreveport. **COLORADO:** Sterling. **NORTH DAKOTA:** Williston. **UTAH:** Vernal.


SAFETY DEPOSIT VAULTS FOR VITAL FUELS... Wyatt welded steel storage, Fabricated and Erected to Specifications for Crude Oil, Refined Products, Chemicals—Any Type, Any Size, Anywhere
20
STEEL PLATE FABRICATORS AND ERECTORS SINCE 1913



Journal-guide to

CRUDE OIL AND NATURAL GAS LIQUIDS ESTIMATED PRODUCIBILITY 1951-1955



FROM REPORT "TRANSPORTATION OF OIL" BY PETROLEUM ADMINISTRATION FOR DEFENSE

ESTIMATED AVAILABILITY OF CRUDE-PETROLEUM AND NATURAL-GAS LIQUIDS BY MAJOR SUPPLY AREAS IN THE UNITED STATES . . . 1951 - 1955

(Thousand barrels daily)

Supply area—	Production 1950	Estimated availability 1951	1952	1953	1954	1955
Crude petroleum:						
N. Y., Pa., Va., W. Va.	51.4	50.5	47.5	44.5	41.5	39.5
Ill., Ind., Ky., Mich., Ohio*	277.7	266.4	261.6	255.8	249.0	242.2
Kans.	294.8	306.0	310.0	312.0	315.0	317.0
Okla.	451.8	517.0	540.0	565.0	580.0	600.0
Miss., Ala., Fla.	106.1	111.5	114.5	117.5	120.5	123.5
No. La. & Ark.	206.4	206.0	207.0	208.0	209.0	207.0
La. Gulf	451.7	550.0	610.0	650.0	675.0	700.0
Gulf & SW. Texas	734.9	1,171.0	1,217.0	1,254.0	1,280.0	1,297.0
East Texas	417.6	514.0	525.0	531.0	537.0	540.0
No., West Central & Central Texas	245.9	293.0	310.0	325.0	336.0	343.0
Panhandle Texas	91.0	90.0	89.0	88.0	87.0	86.0
W. Tex. & N. Mex.	914.0	1,395.0	1,492.0	1,567.0	1,618.0	1,650.0
Colo., Mont., Nebr., Utah, Wyo.	258.4	327.2	345.0	364.5	376.4	386.0
Calif.	889.6	986.0	991.0	995.0	995.0	990.0
Total U. S. (Ex. Naval Reserve)	5,394.3	6,783.6	7,060.6	7,278.3	7,416.4	7,523.2
Naval Reserve No. 1	8.0	95.0	7,100.0	97.0	94.0	90.0
Grand total	5,402.3	6,878.6	160.6	7,375.3	7,510.4	7,613.2
Natural gas liquids:						
N. Y., Pa., Va., W. Va.	13.7	14.4	15.1	15.7	16.4	17.0
Ill., Ind., Ky., Mich., Ohio*	13.8	15.0	15.5	15.8	16.1	16.1
Kans.	10.8	12.5	14.0	15.0	15.8	16.2
Okla.	40.2	46.7	52.5	57.1	61.2	64.2
Miss., Ala., Fla.	3.5	3.5	3.6	3.6	3.5	3.4
No. La. & Ark.	40.6	43.7	45.7	47.7	48.7	49.0
La. Gulf	21.7	23.0	25.0	27.0	30.0	34.5
Gulf & SW. Tex.	85.6	103.5	115.0	121.0	126.0	130.0
East Texas	67.4	72.3	75.1	76.8	77.7	78.3
No., W. Central, and Central Texas	17.7	19.0	20.4	21.8	23.1	24.3
Panhandle Texas	43.8	50.9	54.5	56.5	58.2	59.5
W. Tex. & New Mex.	55.5	78.5	101.3	117.8	129.5	139.3
Colo., Mont., Nebr., Utah, Wyo.	5.9	6.2	6.5	6.7	7.0	7.2
Calif.	77.3	86.0	87.0	88.0	89.0	89.0
Total U. S. (Ex. Naval Reserve)	497.4	577.2	631.2	671.6	702.6	728.3
Naval Reserve No. 1		7.0	7.0	7.0	7.0	7.0
Grand total	497.4	584.2	638.2	678.6	709.6	735.3
Total crude and gas liquids:						
N. Y., Pa., Va., W. Va.	65.1	64.9	62.6	60.2	57.9	56.5
Ill., Ind., Ky., Mich., Ohio*	291.6	281.4	277.1	271.7	265.1	258.3
Kans.	304.6	318.5	324.0	328.0	330.8	333.2
Okla.	492.0	563.7	592.5	622.1	641.2	664.2
Miss., Ala., Fla.	111.6	115.0	118.1	121.1	124.0	126.9
No. La. & Ark.	247.2	249.7	252.7	255.7	256.7	256.0
La. Gulf	473.4	573.0	635.0	677.0	705.0	734.5
Gulf & SW. Tex.	820.5	1,274.5	1,332.3	1,375.0	1,406.0	1,427.0
East Texas	485.0	586.3	600.1	607.8	614.7	618.3
No., W. Central & Central Texas	263.6	312.0	330.4	346.8	359.1	367.5
Panhandle Texas	134.8	140.9	143.5	144.5	145.2	145.5
W. Tex. & N. Mex.	969.5	1,473.5	1,593.3	1,684.8	1,745.5	1,789.3
Colo., Mont., Nebr., Utah, Wyo.	265.3	333.4	352.5	371.2	383.4	393.2
California	966.9	1,072.0	1,078.0	1,084.0	1,084.0	1,079.0
Total U. S. (Ex. Naval Reserve)	5,891.7	7,360.8	7,691.8	7,949.9	8,119.0	8,251.5
Naval Reserve No. 1	8.0	102.0	107.0	104.0	101.0	97.0
Grand total	5,899.7	7,462.8	7,798.8	8,053.9	8,220.0	8,348.5

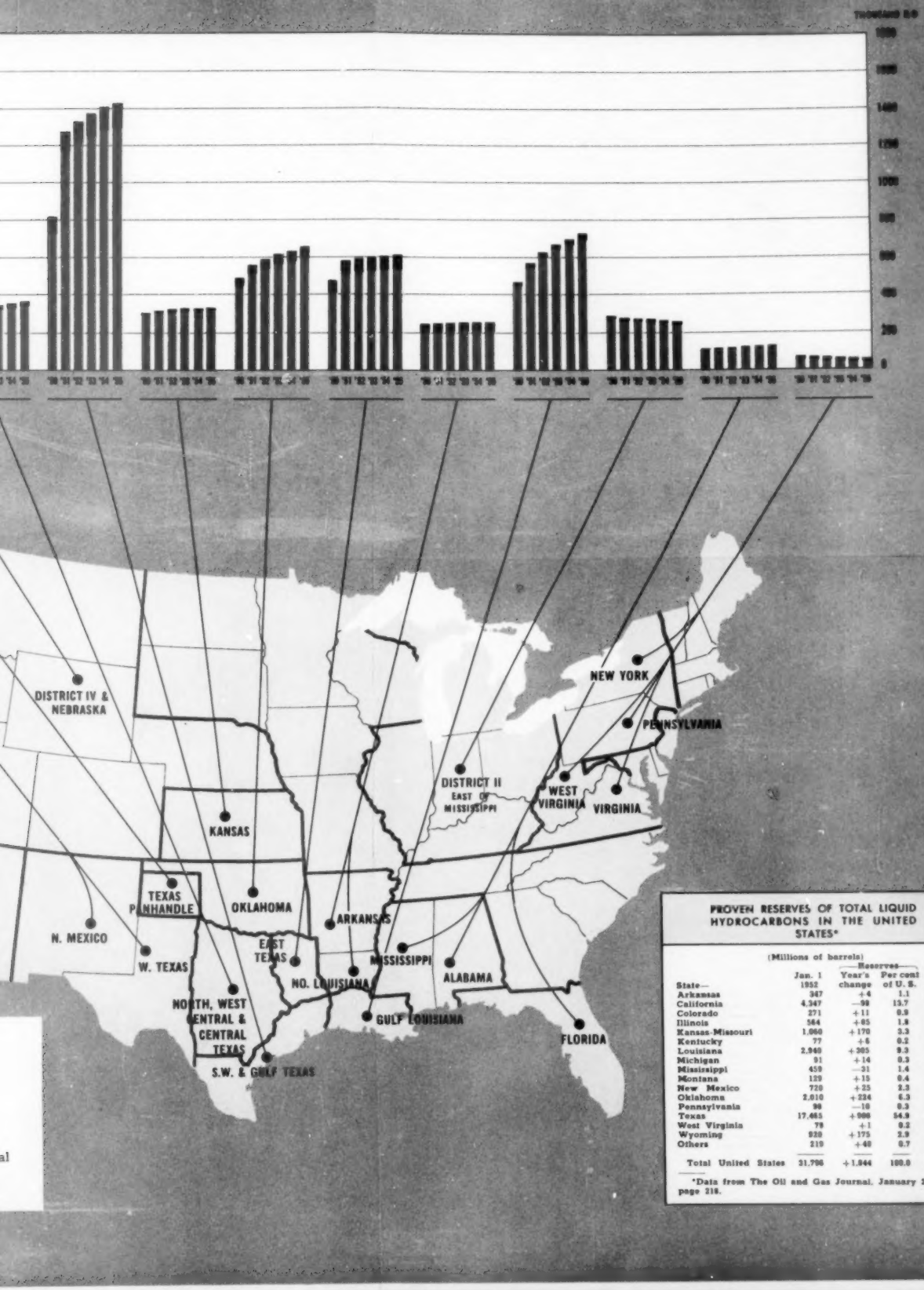
*Includes approximately 200 bbl. daily each year representing combined production of Tennessee and Missouri.

LEGEND

CRUDE AVAILABILITY

NATURAL GAS LIQUIDS

Supplement to The Oil and Gas Journal
Issue of May 19, 1952



PROVEN RESERVES OF TOTAL LIQUID HYDROCARBONS IN THE UNITED STATES*

(Millions of barrels)

State—	Reserves Jan. 1 1952	Reserves Year's change	Reserves Per cent of U. S.	No. wells prod.
Arkansas	347	+4	1.1	3,749
California	4,347	—98	13.7	30,227
Colorado	271	+11	0.9	852
Illinois	544	+65	1.8	33,247
Kansas-Missouri	1,060	+170	3.3	31,272
Kentucky	77	+6	0.2	15,515
Louisiana	2,940	+305	9.3	12,879
Michigan	91	+14	0.3	3,904
Mississippi	459	—31	1.4	1,480
Montana	129	+15	0.4	3,179
New Mexico	720	+25	2.3	6,104
Oklahoma	2,010	+224	6.3	38,612
Pennsylvania	98	—10	0.3	55,900
Texas	17,465	+900	54.9	129,959
West Virginia	78	+1	0.2	14,800
Wyoming	920	+175	2.9	5,587
Others	219	+48	0.7	60,701
Total United States	31,796	+1,944	100.0	447,970

*Data from The Oil and Gas Journal, January 28, 1952, page 218.

skeletons we don't try to hide

A scrap pile is something you wouldn't expect a manufacturer to advertise. It's different at Hughes! We're proud of our rock bit scrap pile!

It shows that our inspectors are alert . . . that faulty bits are discovered before they can cost you valuable drilling time . . . or become expensive failures in the hole.

The cones shown above, in various stages of manufacture, were rejected in one of 40 or more separate inspections that started with the bar stock*.

Counting all parts, more than 275 inspections—*including the use of electronic inspection equipment*—are made to assure the dependability of the finished bits.

There are 253 inspectors at Hughes. They have an average of ten years' experience.

This is another example of the care that goes into the manufacture of all HUGHES Rock Bits. And another reason why they are accepted as the "Standard of the Industry" throughout the world.

*This valuable high alloy scrap is shipped weekly to mills for remelting.

HUGHES Tri-Cone® ROCK BITS